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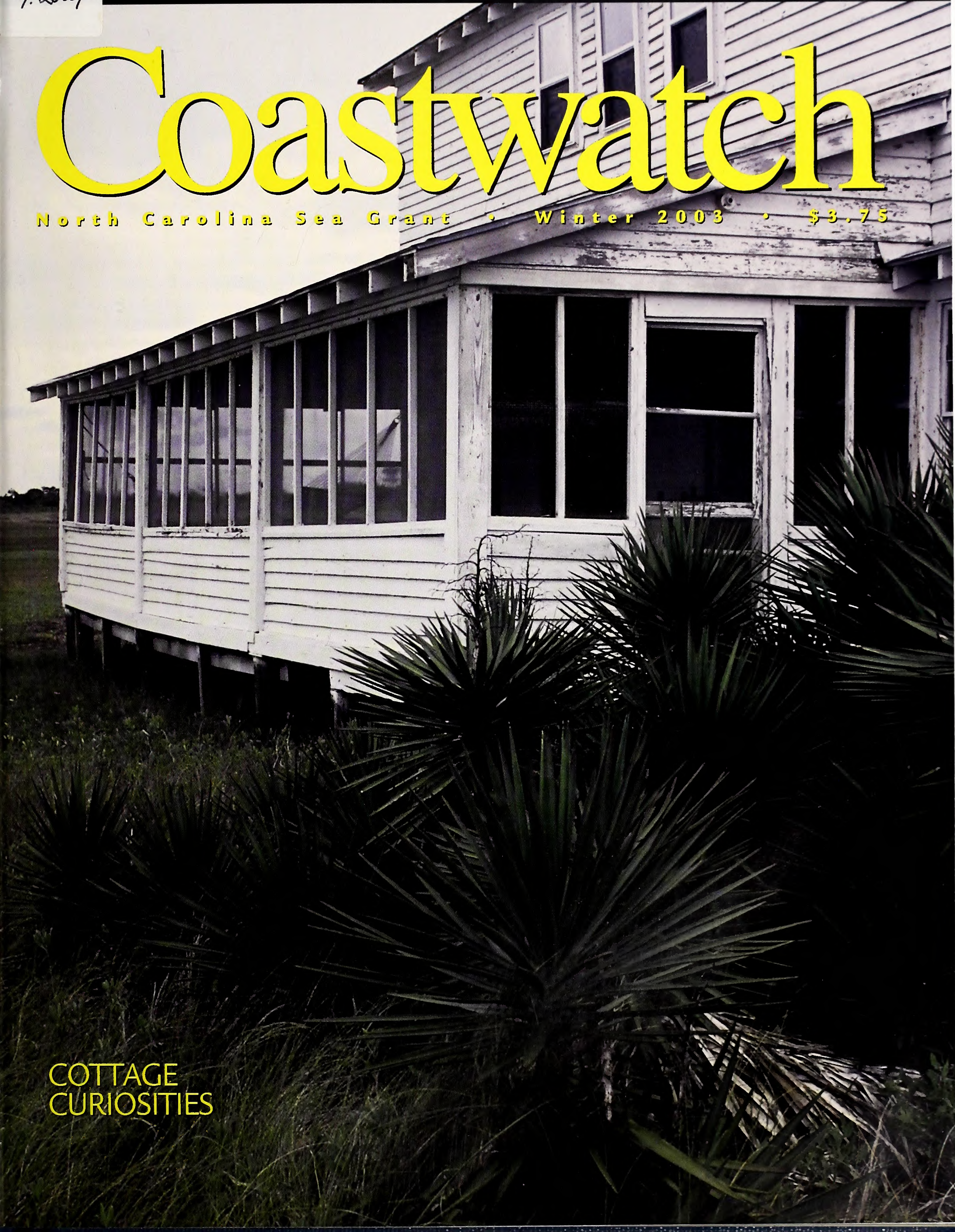
HERN FLOUNDER • SEA TURTLES • WHALE TALES

Coastwatch

North Carolina Sea Grant • Winter 2003 • $3.75



COTTAGE
CURIOSITIES

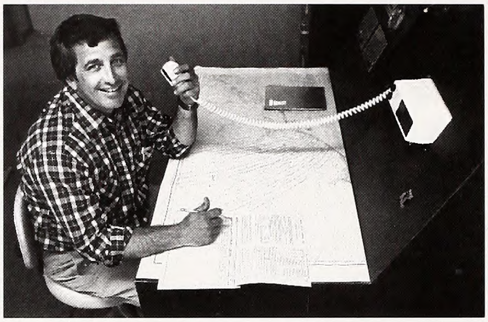
FROM THE EDITOR

New Year's Changes

With the arrival of 2003, many of us are working on new resolutions.

For Jim Bahen, North Carolina Sea Grant fisheries specialist based in Wilmington, one resolution was both professional and personal. He would retire.

But lucky for his Sea Grant colleagues and others up and down the coast, Jim will work on a part-time basis in 2003, including representing Sea Grant on state, regional and national advisory panels. "It's hard to walk away. I am appreciative that I can wean myself," he says with a chuckle.


North Carolina Sea Grant file photo

Jim Bahen's early projects included a weather information relay program.

He also will continue to focus on recreational fishing, including catch-and-release methods and ethical angling, as well as a regional Sea Grant workshop for charter boat captains Feb. 11-12 in Chesapeake, Va.

The fishing communities, both recreational and commercial, know Jim's engaging personality — and his tenacity for encouraging decisions to be based on scientific evidence. Decisions may be made by a weekend angler choosing tackle, by a commercial fishing family considering new gear options, or by state, regional or national officials setting policy or regulations.

Once Jim is set on a project, he gathers up partners and moves full steam ahead.

Those personality traits were apparent from his first days in the fisheries world — when he joined the N.C. Division of Marine Fisheries (DMF) for a study of striped bass and other anadromous fish. His colleagues on the project included Preston Pate, now DMF director.

In October 1977, Jim became the third agent in the then-named North Carolina Sea Grant Marine Advisory Service, and the first to focus on the state's southern coast. "I hired Jim because he had good people skills," says B. J. Copeland, Sea Grant director at the time.

"Researchers are smart people, but we needed smart people who could take the information to coastal residents," he adds.

And Jim headed to the docks to introduce the Sea Grant extension concept. "No one was voting for us, but we were out there shaking hands," he says, recalling many of the fishing captains by name — and even a few of their dogs.

Early projects included a weather relay network in which the fishing boats reported current conditions, which were then shared with the National Weather Service to update forecasts.

Personal connections proved critical when controversial topics arose, such as when Sea Grant worked with the fishing industry and regulators to evaluate TEDs and BRDs (turtle excluder devices and bycatch reduction devices). By helping to bring all players to the table, Jim helped the transition to the new gear. "He did a terrific job on that," Copeland recalls.

Folks at the N.C. Commercial Fishing Show can thank Jim for organizing the first such show more than 20 years ago. The N.C. Fisheries Association now runs the show, but Sea Grant still participates.

The variety of topics over the years pleased Jim. "You never knew from day to day where it might take you," he says.

And even when he moves out of a formal Sea Grant role, you can bet that if you run into him on the docks and pose a fisheries question, he'll suggest the best way to get the correct answer. That's just Jim's nature.

What other changes are in store for North Carolina Sea Grant in 2003? Stay tuned come Spring.

Katie Mosher, Managing Editor

IN THIS ISSUE

Contributing Writers:

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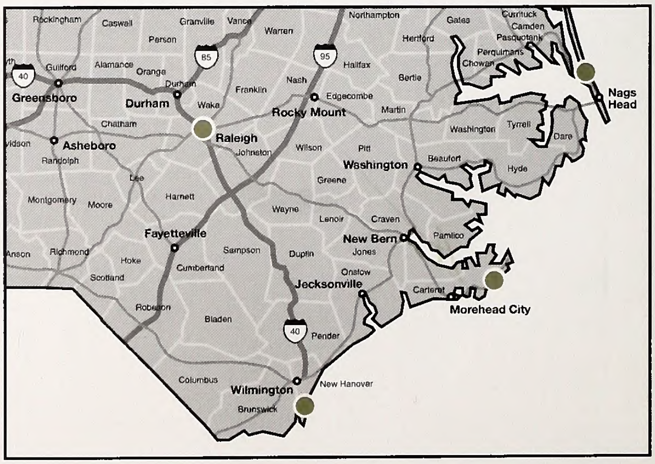
Pam Smith ▫ Ken Taylor ▫ Scott D. Taylor ▫ Sherri Thomas

North Carolina's diverse coast offers countless interesting subjects. The large dots on the locator map indicate story settings in this issue — including the Outer Banks, Carteret County and Fort Fisher.



Coastwatch

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Coastwatch

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The North Carolina Sea Grant College Program is a federal/state program that promotes the wise use of our coastal and marine resources through research, extension and education. It joined the National Sea Grant College Network in 1970 as an institutional program. Six years later, it was designated a Sea Grant College. Today, North Carolina Sea Grant supports several research projects, a 15-member extension program and a communications staff. Ron Hodson is director. The program is funded by the U.S. Department of Commerce's National Oceanic and Atmospheric Administration and the state through the University of North Carolina.
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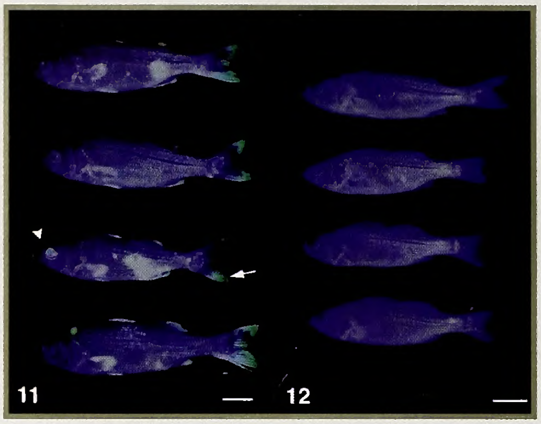
North Carolina

Front cover photo of a Core Banks cottage and table of contents photo of a sand dune by Scott D. Taylor. Printed on recycled paper.

COASTAL TIDINGS



Courtesy of NC State College of Veterinary Medicine

Researchers Find New Method for Detecting Skin Disease in Fish

North Carolina Sea Grant researchers have discovered that a fluorescent dye can be used to assess the health of fish.

The scientists found that fluorescein, a nontoxic dye that glows in the dark, can be used to detect the presence of skin diseases in all types of fish, including rainbow trout, channel catfish, goldfish and hybrid striped bass.

"Fluorescein has the potential to be an inexpensive, safe and highly sensitive way of detecting skin damage in fish," says Ed Noga of the North Carolina State University College of Veterinary Medicine.

"Skin infections are the most common maladies affecting both cultured and wild fish. Virtually every fish population at one time or another is affected by some type of skin damage. This test can be used by anyone who works with fish, including the aquaculture industry, aquariums and pet stores."

Noga's co-investigator was NC State veterinary medicine graduate student Pareeya Udomkusonsri. The study appeared in the November 2002 issue of *Veterinary Pathology*.

This is the first time that researchers have used fluorescein for detecting skin ulceration in fish. The dye commonly has been used to detect ophthalmic lesions, such as cornea ulceration in humans and animals. It also has been used as a trace in clinical studies of ocular blood flow or angiography.

"The beauty of this test is that it allows you to look at the entire body of the fish," says Noga. "Now, researchers use histology to detect skin diseases. Histology is very expensive, time-consuming and not very accurate at detecting skin diseases in fish."

With early intervention of skin ulcers, he says, treatment is more likely to be successful.

"The early stage of skin damage is much easier to manage than large visible ulcers," Noga adds.

The use of this test would be particularly important for the aquaculture industry where fish are reared under very high stocking densities, offering potential for disease outbreaks.

The channel catfish industry is the largest aquaculture section in the United States, generating nearly $400 million annually, according to Noga. In North Carolina, the total estimated value of catfish aquaculture in 2001 was more than $4 million, according to the N.C. Department of Agriculture & Consumer Services.

In 2001, the state's overall aquaculture enterprises were estimated to be worth nearly $21 million, including catfish, trout, hybrid striped bass, tilapia, crawfish, ornamentals and shellfish.

North Carolina Sea Grant Director Ronald G. Hodson says the study has important implications for the aquaculture industry, aquariums and pet stores.

"Detecting skin diseases early will allow producers to make adjustments in their culture practices to improve water quality," says Hodson. "This reduces the need for antibiotics or other chemical treatments to improve the health of the fish."

– A.G.

In the Next Issue of *Coastwatch*

Celebrate North Carolina Audubon's 100th anniversary with Pam's Smith's coastal visit. Ann Green explains the history of and physically intense training for Outer Banks beach rescue teams. And T. Edward Nickens shares his adventures working the Intracoastal Waterway.

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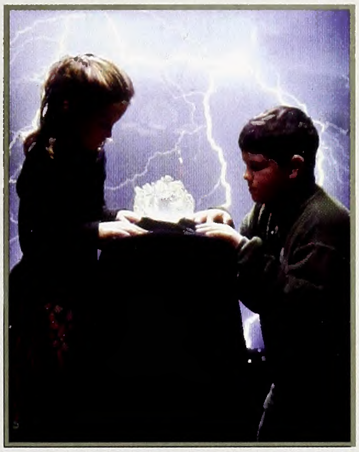
Exhibit Reveals 'Powers of Nature'



Photos courtesy of the Franklin Institute Science Museums

Have you ever wanted to shake the ground like an earthquake, or create your own tornado? Then visit the "Powers of Nature" exhibit at the North Carolina Museum of Natural Sciences in downtown Raleigh.

Originally from Philadelphia's Franklin Institute Science Museums, the exhibit runs through Feb. 16.

More than 50 interactive exhibits, video presentations and real artifacts for young and old alike teach about nature's amazing influences. In the "Anatomy of a Storm," you can learn how a storm is formed and see how a 16-ft. tree was bent to a 90-degree angle from Hurricane Hugo.

In "Earthquakes," you can try to build a building to withstand the movement of a real earthquake. In "Volcanoes," see inside a volcano and create your very own mini-eruption.

Admission is $4 for adults; $3 for children 4-11 and senior citizens over 60; free for Friends of the Museum and children 3 and under.

For more information about museum hours, call 919/733-7450, ext. 503 or visit the Web: *www.naturalsciences.org* and click on Special Exhibits. — G.C.

Shark Brochure Available

After almost 400 million years in the ocean, sharks have developed a reputation as very dangerous fish.

Although a shark attack is a potential danger for anyone frequenting marine waters, the risk should be kept in perspective, says George Burgess, director of the International Shark File in Florida.

A new colorful brochure, "Shark Sense: Atlantic and Gulf Regions," addresses the dangers of sharks and gives tips on how to avoid shark attacks. The publication also illustrates common sharks found in the Atlantic and Gulf, and gives some interesting facts about the predators and shark resources.

The brochure was a cooperative effort of North Carolina Sea Grant, NOAA Fisheries, Florida Sea Grant, Rhode Island Sea Grant, Dare County Emergency Management and North Carolina Aquariums.

To request a sample, call 919/515-9101; or write North Carolina Sea Grant, NC State University, Box 8605, Raleigh, NC 27695-8605; or visit the Web: *www.ncsu.edu/seagrant*. Refer to UNC-SG-02-07. — A.G.

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Scott D. Taylor

Coastal Real Estate Workshops Offered

What should you know about selling and buying coastal real estate? Find out in February when the N.C. Real Estate Commission and N.C Division of Coastal Management team with North Carolina Sea Grant to host workshops in three locations.

- Feb. 10, 1 to 5 p.m., Sun Spree Resort, Wrightsville Beach
- Feb. 11, 9 a.m. to 1 p.m., Sun Spree Resort, Wrightsville Beach
- Feb. 20, 9 a.m. to 1 p.m., Ramada Inn Outer Banks Resort, Nags Head
- Feb. 21, 9 a.m. to 1 p.m., Sheraton Atlantic Beach

Experts will discuss construction standards, erosion rates and controls, disclosure requirements and resources for buying and selling real estate.

The workshops are open to the public. Registration is $45 per person. Real estate licensees will receive four hours of continuing education elective course credit.

Checks should be payable to N.C. Real Estate Commission. Mail checks, indicating date and location of workshop of choice, to N.C. Real Estate Commission, Education Specialist, P.O. Box 17100, Raleigh, NC 27619-7100.

For additional information, go online to *www.ncrec.state.nc.us.* — P.S.

Pam Smith

Amy Sauls is honored for her coastal education efforts.

Amy Sauls Tapped for Honors

Amy Sauls, a marine educator with the N.C. National Estuarine Research Reserve program, has been named Informal Educator of the Year by the Mid-Atlantic Marine Education Association (MAMEA).

Sauls was cited for providing opportunities for teachers to become leaders in marine, coastal and environmental science through workshops and field study programs. Sauls also was recognized for forming partnerships with state, federal and private agencies for teacher training. She helped develop *Estuary Live*, an award-winning Internet-based education program that enhances classroom instruction.

Sauls has been based at the Rachel Carson reserve in Beaufort since 1997. She holds a bachelor's degree in biology from Meredith College and a teacher's certificate from the University of North Carolina at Wilmington.

MAMEA is a chapter of the National Marine Educators Association, which works to improve education about marine and aquatic environments. — P.S.

Annual Commercial Fishing Show Set

It's that time of year again for the Annual North Carolina Commercial Fishing Show sponsored by the N.C. Fisheries Association. The latest technologies will be showcased at the Riverfront Convention Center in New Bern, on Saturday, Feb. 22, from 9 a.m. to 6 p.m., and Sunday, Feb. 23, from 10 a.m. to 4 p.m.

The fishing community from up and down the East Coast will gather to view this year's marine technologies — and there are plenty of activities for youngsters to enjoy.

A variety of vendors will showcase new electronics, gear, equipment, packaging, boats and more. North Carolina Sea Grant and other agencies will host educational exhibits. Also, an assortment of seminars will be held, including the presentation of results from research projects funded by the N.C. Fishery Resource Grant and Blue Crab Research programs.

For more information on seminar topics, contact Bob Hines, Sea Grant fisheries specialist at 252/222-6312, *rjhines@unity.ncsu.edu.*

For more information on the show, call the Fisheries Association, 252/633-2288. Online, go to: *www.nc.fish.org* and click on events.

— G.C.

Jody Duggins/NCWRC

Tracking Black Bears in Coastal Plain

How do you get a DNA sample from a black bear roaming the Hyde County coastal plain? Very carefully.

North Carolina State University researchers have devised a way to snag hair samples from bears lured into barbed wire corrals. Phil Doerr, professor of zoology, and doctoral student Tim Langer "plant" various chemical scents to attract the bears into the corrals — constructed with a single strand of barbed wire 18 inches high, and 18 feet square. Hair follicles caught on the wire are analyzed to identify individual bears — without making physical contact with the animals.

Mapping critters' movements takes a higher level of technology. Doerr and Langer are using microprocessors and Global Positioning Satellites (GPS) to track ten bears that have been fitted with radio transmitter collars. The collars are programmed to search for GPS signals and record bear locations over a six-month period.

The collars are programmed to fall off at a predetermined time. Then, the researchers will use a radio receiver to collect them for analysis. The data will enable researchers to know the bears' movement patterns, their habitat preferences, and their locations in relationship to human activity.

The research is funded by NC State and the N.C. Wildlife Resources Commission, which is interested in developing new methods for monitoring and managing black bear populations.

One of the largest populations of black bears in the state is in the coastal plain, which provides an abundant diet of winter wheat, corn and soybeans from April through early winter. — P.S.

Lessons From the Edge of the Sea

A group of individuals concerned about North Carolina's coast developed the Southern Coastal Heritage Workshops for educators. Sponsored by the North Carolina State University Humanities Extension Program, the workshops explored communities and ecosystems.

Now, everyone has a chance to experience the workshops in *Life at the Edge of the Sea: Essays on North Carolina's Coast and Coastal Culture,* edited by Candy Beal and Carmine Prioli, of NC State.

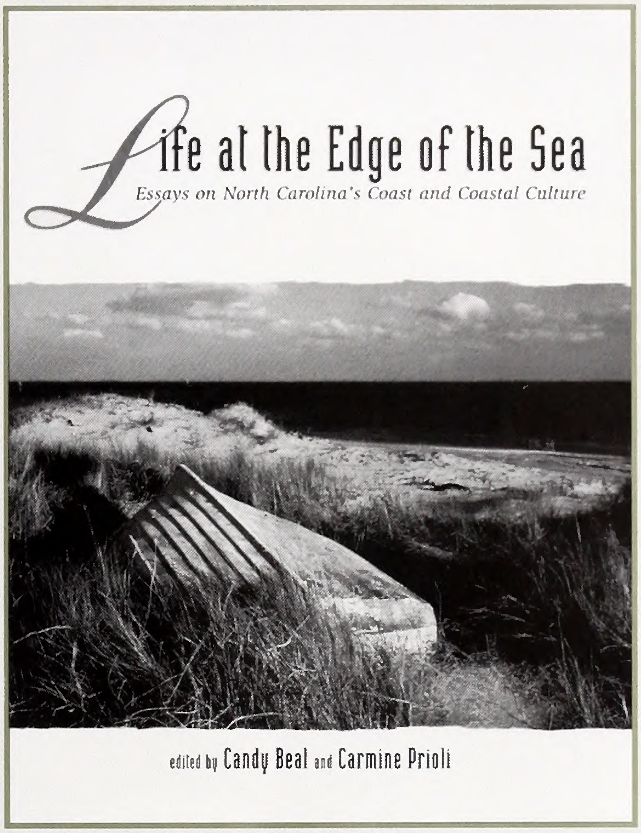
In the essays, the workshops come alive. Find yourself knee-deep in muck with Lundie Spence, North Carolina Sea Grant education specialist. "Estuaries: Where the River Meets the Ocean," describes one of the largest estuarine systems on the East Coast, second only to Chesapeake Bay.

Or take a trip to the Outer Banks with Walt Wolfram of NC State. In "Speech at the Beach," you can almost hear the unique coastal dialects.

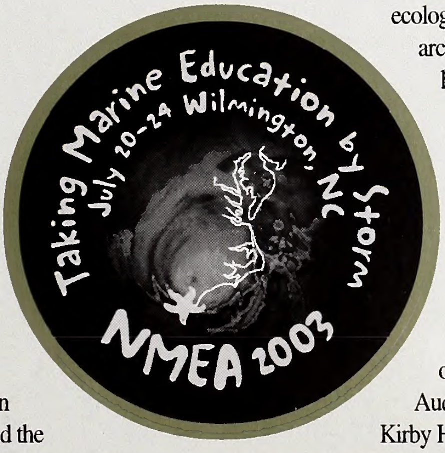
Follow the time line of how the Cape Lookout National Seashore came into being or how it almost did not become at all. Learn about African-American influence in the development of coastal waterways. Or even experience boat building on Harker's Island. The collection of essays can open up a new world or make memories come flooding back. Either way, North Carolina's coastal traditions and stories will live on.

To purchase a copy of the book for $16.95, call Coastal Carolina Press, 910/362-9298, or send the request via email to *books@coastalcarolinapress.org.*

– G.C.


Life at the Edge of the Sea
Essays on North Carolina's Coast and Coastal Culture
edited by Candy Beal and Carmine Prioli

National Marine Educators to Meet in Wilmington



The 2003 National Marine Educators Association Conference, "Taking Marine Education by Storm," will convene July 20 – 24 at the University of North Carolina at Wilmington's Center for Marine Science.

The event is hosted by the Mid-Atlantic Marine Education Association, UNC-W, and the National Marine Education Association. North Carolina Sea Grant is a conference sponsor.

Speakers will share the latest marine science research through workshops and field trips. Sessions will highlight marine geology, ecology, meteorology, archaeology and marine history.

Special events include a tour of the newly expanded North Carolina Aquarium at Fort Fisher.

Conference chairs are Andy Wood, of the North Carolina Audubon Society, and Terri Kirby Hathaway, of the North Carolina Aquarium at Roanoke Island.

Go online to *www.marine-ed.org/nmea2003* for conference information and registration applications. Or, contact Wood at *awood@audubon.org* or Hathaway at *terri.hathaway@ncmail.net.*

– P.S.

Volunteers Needed for N.C. Ocean Bowl

This spring, North Carolina high school students will test their knowledge of ocean science in a team competition.

The students will answer questions about ocean-related science, technology, history and navigation March 1 at the Fourth Annual North Carolina Ocean Sciences Bowl at the University of North Carolina at Wilmington.

Winners of the N.C. Ocean Bowl will compete in the National Ocean Sciences Bowl April 25-28 in La Jolla, Calif.

Volunteers are needed to judge and monitor the North Carolina competition.

To volunteer, contact Diane Talley, 910/962-2460, or *marinequest@uncw.edu*

– A.G.

Core Banks Cottages Rich in History, Tradition

By Ann Green
Photos by Scott D. Taylor

LEFT: The Barden Cottage was originally a lighthouse keeper's quarters.

RIGHT: For years, the Cape Lookout Lighthouse has been a landmark for mariners.

As soon as Wilson Davis pulls up in his boat to the shoreline near his wooden cottage on Core Banks, he steps back to a "different way of life."

If the wind is blowing right, he leaves the door open to catch the sea breezes.

Before sunset, he rocks on the front porch and watches the clouds back up over the marsh and the aquamarine waters of Core Sound on Cape Lookout National Seashore.

At night, he often lights the long, open hallway with kerosene lanterns instead of turning on the generator.

"This place means everything to me," says Davis. "It is my family's history."

The open hallway that runs throughout the house has a long table covered with a red checkered tablecloth where the Davis family gathers for seafood dinners. The white walls are decorated with several murals painted by family members. Scenes include fish and the beach buggy "Hot Fire."

"We used to have a red buggy," says Davis. "My cousin Laura went in the beach buggy, and it broke down. Then she painted it 'Hot Fire.' "

Since the early 1950s, the beach cottage — which is known as the Coca-Cola house because the original owners held a soft drink franchise — has been a gathering spot for various Davis kinfolk.

Harry T. Davis, curator at the former North Carolina State Museum of Natural History, was the first owner from the Davis family.

"My Uncle Harry used to band falcons out here," he says. "When he gave the house to me and my cousin Warren Davis, he told us he was getting rid of a pink elephant because the house needs so much maintenance."

Continued

TOP: The wood-framed Life Saving Station has gables on the front.
BOTTOM: Ben Dawsey and his family often retreat to The Sea Dollar.

During the 1960s, Wilson Davis commuted back and forth by boat between Straits and the Cape while his wife and children lived at the cottage all summer.

"It was nothing to come here from work and have four young'uns waiting for their daddy on the porch," says Davis. "Whenever my children come here now, they feel close to the Cape."

Over the years, the house has withstood numerous hurricanes and nor'easters. The only destruction has been shredded roofs and other minor damage, says Davis.

"I remember a nor'easter that threw a boat on the sand dunes," he says.

The Coca-Cola house is one of the few houses still occupied by seasonal residents in the Cape Lookout Historic District on the southern end of Core Banks. There are no permanent residents on the island, which is accessible only by private ferry or boat.

"Each of the remaining cottages has a different story," says North Carolina Sea Grant marine education specialist Lundie Spence. "I love the architecture and how they were designed for that location, including the Coca-Cola house with its porches and interior openness. It is a great example of a 'design with nature.' "

Special Leases

Fourteen houses in the historic district are under lease from the National Park Service, which owns the 28,243-acre seashore that stretches more than 56 miles — from Beaufort Inlet to Ocracoke Inlet, including Shackleford Banks and North and South Core Banks.

Core Banks — a single island from the late 1800s until a 1933 hurricane cut an inlet through it — is divided at New and Old Drum inlets into South Core Banks, Middle Core Banks and North Core Banks. Barden's Inlet came as a result of the 1935 hurricane.

In August 2001, some property owners on South Core Banks initiated a legal battle over expiring leases. When Core Banks was transferred from the state of North Carolina to the National Park Service in 1976, some cabin owners who did not want to sell were given 25-year leases that allowed them to use the houses after the official transfer.

Recently, the Park Service settled the

lawsuit, which allows 11 leasees to occupy their cabins under special-lease permits until Sept. 4, 2003, while officials assess the historic and nonhistoric structures.

"We will have a public planning process in 2003," says Bob Vogel, park superintendent. "The Park Service is looking at a variety of options for the use of the cabins, including establishing a historic leasing program that allows private citizens to lease structures in exchange for maintaining them according to historic standards. Six buildings in the historic Portsmouth Village on the northern end of the seashore are in that program."

New Bern attorney Hugh Overholt, who represented several leaseholders in the federal lawsuit, says that the settlement was "reasonable given the facts and circumstances."

In addition to historic leasing, Vogel says, other options will be considered, including opening one or more of the structures to the public as a museum or an educational center. The Park Service also is considering using the structures for administrative needs, such as housing for volunteers and park staff stationed on the Banks, he adds.

Now, the brick Keeper's Quarters, which was built in 1873 and sits next to the Cape Lookout Lighthouse, is the only structure in the historic district open to the public.

The district — which is anchored by the diamond lighthouse at the north end and the former U.S. Coast Guard Station to the south — contains 21 principal structures.

Village's Rich History

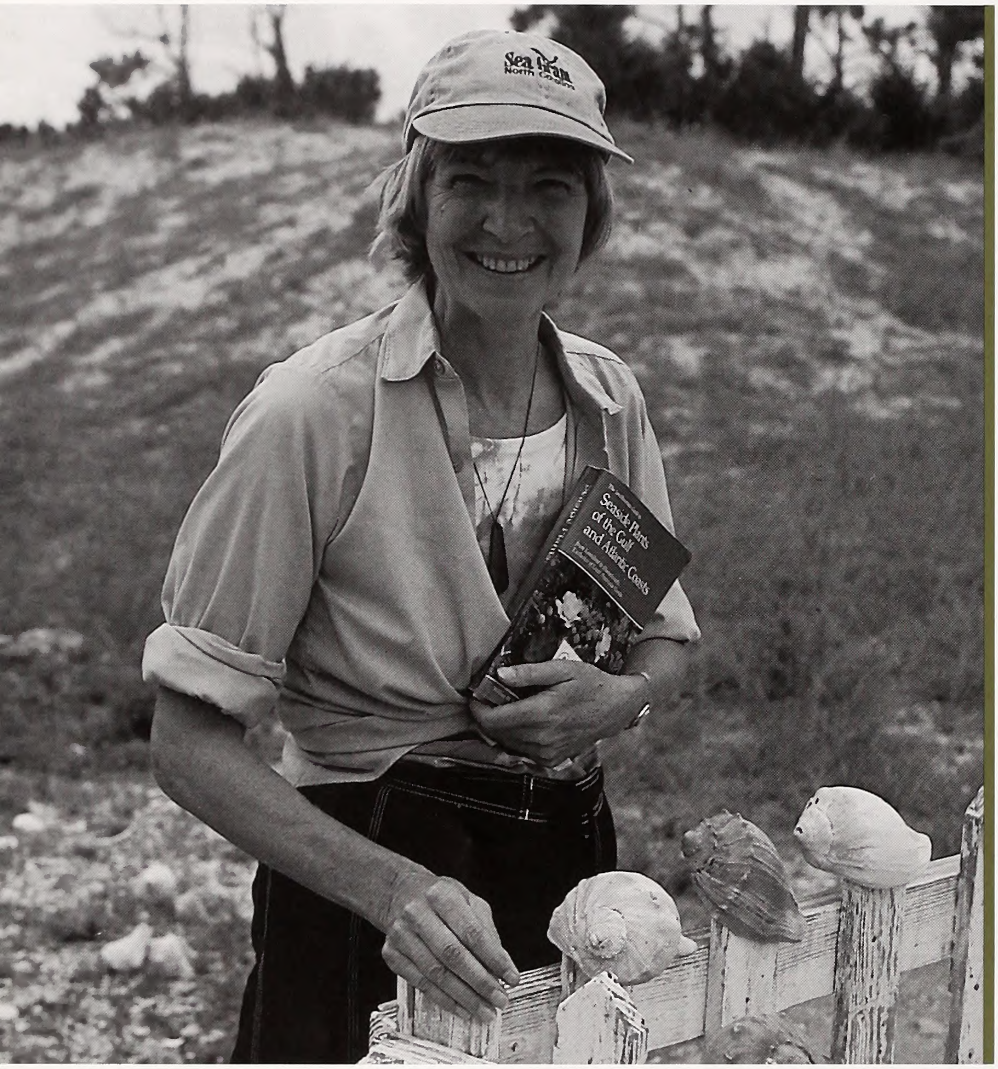
From the 1870s to about 1920, the area flourished as a fishing village. Fishing families or U.S. Coast Guard employees built several of the historic private dwellings as residences.

After that, the Cape became a haven for hardy vacationers.

During World War II, the Cape was buzzing with military activity. After Germany U-boats attacked and sank many ships near Cape Lookout in 1942, the Cape was developed as a temporary defensive base. Along the beach on the Atlantic side, you can still find ruins of machine guns and searchlight towers.

Continued

TOP: David Yeomans' buoy tree in his front yard is favorite stop for tourists on Core Banks.
BOTTOM: The Coca-Cola House has a front porch that faces Core Sound.



TOP: Lundie Spence, North Carolina Sea Grant education specialist, looks at seashells piled along railings at the former U.S. Coast Guard station, now used as a N.C. Maritime Museum field station. BOTTOM: Fishing is a popular activity along Core Banks.

For the rest of the 1940s, 1950s, and 1960s, Core Banks was a retreat for seasonal residents, many of whom were connected to the Cape by deep family roots.

June Long, who has been coming to her cottage since the 1950s, says it was a "closeknit group."

"My father came to the Cape from the 1920s until his death in 1972," says Long. "There were still horses and cattle on the island in the 1950s."

Long-time seasonai residents were over here like David Yeomans, who still has a home at the Cape, she says. "The Coast Guard was active. Everybody was friendly. If your car got stuck in the sand, the Coast Guard would come and help you get out."

From the 1950s to 1970s, the Cape also was abuzz with real estate activity, including the state of North Carolina's purchases for a proposed state park.

When the Park Service took over the island from the state in the 1970s, many changes began occurring, including the legal status of the cottages.

"We couldn't land our plane on the island anymore," says Long.

In the 1980s, the Coast Guard station was decommissioned. The building is now being used as a field school for the N.C. Maritime Museum in Beaufort. Different shaped seashells adorn the railings. Clusters of rattlebrush speckle the yard with their fiery red petals.

Island Tour

To get to North Core Banks, you have to take the Alger Willis ferry from Davis. After arriving, you need a four-wheel drive vehicle or truck.

While bumping along the sandy back road from North Core to South Core Banks, you pass miles of barren beaches with sand dunes. The first landmark is the diamond lighthouse that overlooks the Atlantic. Soon, you cross a small wooden-planked bridge and see the first cottages in the historic district.

One of the oldest landmarks is the Life Saving Station, which was built in 1888. The two-story building — now a retreat for Samuel and Sara Daniels of Morehead City — has a weathered look with a few bare spots on the roof and some gables.

Not far from the Daniels' cottage is the one-story Life Saving Station Boat House that once was used by the U.S. Coast Guard and is now leased by David Yeomans.

On a recent day, a tour group stopped in front of the house. While standing near a weeping willow tree, Yeomans belted out the local popular song "The Booze Yacht" about a whiskey boat that ran aground during Prohibition.

After the group left, he walked around barefoot near some trees decorated nautical-style with orange, white and green buoys and an old boat.

"Everybody that comes from miles puts a buoy on the tree," says Yeomans, who will turn 82 in February.

As Yeomans walks inside the "Ye Olde Boat House," he says that he put a lot of sweat into this retreat.

In 1958, he moved the 1887 structure building from its original site 500 feet north and remodeled it as a cottage.

He still has the saw that he and a friend used to cut 50 concrete blocks underneath the house.

"I moved the house on rollers," says Yeomans. "It took two of us. I was worn out from moving. I changed the road a little to put the house where it is."

For Yeomans, the cottage is more "home" than his house on Harkers Island.

"My father was here before me and had a garden where the porch is now," says Yeomans. "Horace Nelson with the Coast Guard had a house where the garage is."

A short, compact man with a well-weathered face from his years outside fishing, Yeomans delights in telling stories about the Cape, including being conceived over here.

'There were no midwives here at the time," he says. "My parents carried me home to Harkers Island to be born. At one month, I was christened at the Harkers Island Methodist Church and came right back to Cape Lookout and spent my childhood here."

Over the years, Yeomans has collected a lot of memorabilia from the Cape. The enclosed front porch is decorated with seashells, buoys, including a Russian one that washed ashore from a trawler, and old kerosene lamps used by the Coast Guard to signal ships.

The kitchen still has an old hand pump used before he had a generator. One of the bedrooms has a light bulb that has burned since 1958.

Yeomans and his wife spend all of April, May and October here and always celebrate her birthday on Oct. 27 with a party at the Cape.

Last October, 150 people showed up for the birthday celebration. Since it was rainy, Yeomans says a lot of people had left the Cape. "When the weather is pretty, we set up the tables outside. We have a real good time."

Across the street, the Dawseys from Gastonia and Setzers from Denbigh, Va., lease the "Sea Dollar," a wood-framed structure built around 1940.

The one-story cottage has board and batten siding. Ben Dawsey thinks the original house was built by a Coast Guard employee for his family during World War II.

The living room has a huge stone fireplace, pot-bellied stove and weather vane on the ceiling that tells the way the wind is blowing.

"This is a family place where we have fellowship," says Dawsey, a retired Gastonia veterinarian. "We come by ourselves and sometimes the kids come. We thank the Lord we have had the opportunity to come over here and see nature — birds, fish and turtles crawling on the banks."

Island Vegetation

There are no high-rise buildings in the village except for the lighthouse. The landscape also has remained unaltered except for some scrubby pine trees planted in the 1960s to protect structures from wind and lend stability to the shifting sands. Cedars and myrtles shade many of the village homes.

Along the Core Sound waterfront, the cottages have huge yards that are covered with seagrass. The homes overlook a wide maze of marshy expanse that rings the natural cove known as Cape Lookout "bight." One of the larger homes is the two-story "Casablanca," where natives used to gather for square dances.

A smaller cottage near the bight is the "Long Cottage," which was nicknamed "Never Done" by June Long's children because of the continuous maintenance.

"It is difficult to get things done on the island," says Long who lives in Roanoke Rapids. "We have to bring over everything by boat — from building materials and gas cylinders to the kitchen stove."

The Longs also have to haul everything off the island, including garbage and laundry, and provide their own electricity and water, she adds.

Despite the inconveniences and hardships on the isolated island, Long gets "choked up thinking about it being gone" and so do her friends. "I can hardly put into words what the cottage means to me," she says. "Sometimes we come here for six weeks at a time."

During these retreats, the Longs soak up nature and get to know each other better.

"We sit on the porch and have the best visiting and enjoy each other," says Long. "We go on the beach and swim and swim. Children can go in the marsh. It is so different from anything else."

Not far from the Long cottage is the two-story Barden home that was originally a lighthouse keeper's quarters. Like many of the other homes on the island, it was moved from its original location near the lighthouse to the bight.

Graham Barden Jr., son of the longtime congressman for whom Barden Inlet was named, was given the lot as a gift from his father's law partner in 1957. Then he and two friends bought the house for $666, according to Graham Barden III, a New Bern physician.

He vacationed at the Cape as a child and has vivid memories of carrying gallon jugs of water from the Coast Guard station to his house.

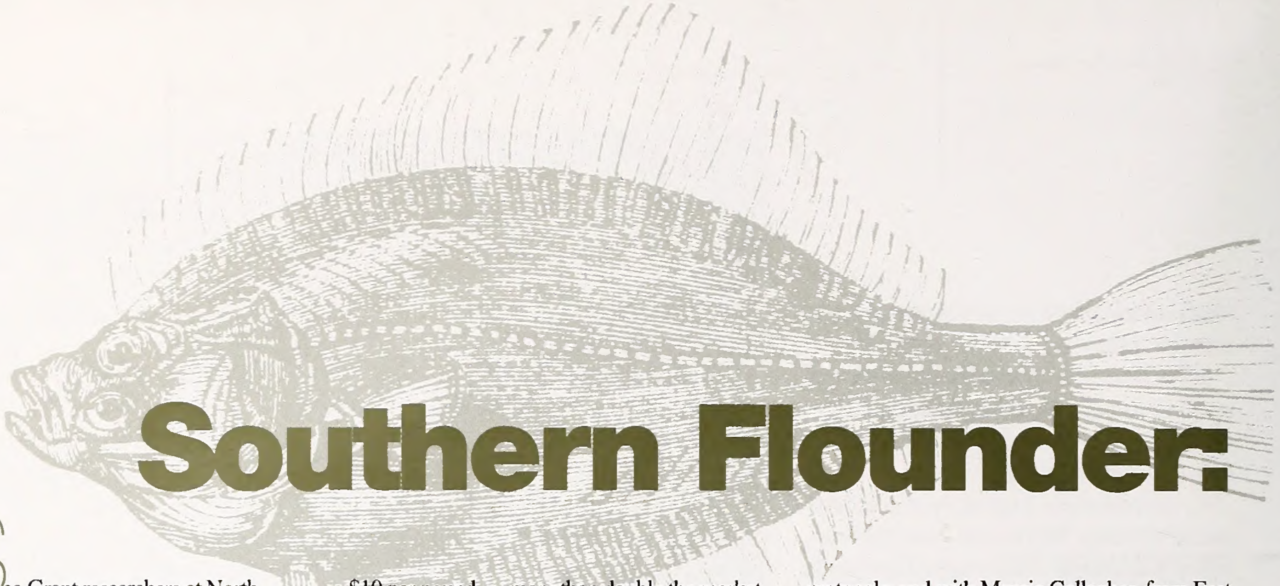
"We found out later that our well was as deep as the one at the station," he says.

Recently, the Bardens added solar power.

"I had to learn to do everything here — from plumbing to electrical work," he adds.

Barden and his family now spend about 60 nights a year on the island and hope to leave their footprints for many more years.

"To me, it is home," says Barden. "It is quiet and peaceful. I feel bounded by the house. I would move from my New Bern home but don't want to live in this place. I am grateful we are going to have more time here."



Southern Flounder:

Sea Grant researchers at North Carolina State University are turning up the heat on Southern flounder to produce all-female cultured stocks. The controlled-breeding method relies on water temperature manipulation during the flounder's early development — not on genetic engineering.

From a pure science standpoint, their research results are important, since most temperature-dependent sex determination has been documented in reptiles, such as some turtles and lizards, and all crocodiles and alligators.

"From an economic standpoint, that is significant," says Russell Borski, a zoology professor and member of the flounder research "dream team."

The production of all-female stock pushes the Southern flounder up a notch as a candidate for aquaculture in North Carolina, he says.

Studies show that female flounder grow two to three times the size of male flounder within two years — a reasonable grow-out period for aquaculture operations. Given the high consumer demand and high world-market value for flounder, the ability to produce larger fish in a short period of time could add up to handsome investment returns.

The production of farm-raised finfish, such as hybrid striped bass, tilapia and trout, is expanding in North Carolina, according to N.C. Department of Agriculture and Consumer Services figures. But, there are no Southern flounder-farming operations that rear fish from egg to market-size here — or anywhere in the U.S. for that matter.

Japan leads the way in technology for producing farm-reared flounder. For their somewhat exclusive efforts, they are rewarded with a per fish market price of between $5 and $10 per pound — more than double the market price for hybrid striped bass, tilapia or trout.

Borski and his colleagues would like nothing better than to see North Carolina capture a substantial share of the profits from the global flounder market.

A step closer

Clustered in the zoology department in the NC State College of Agriculture and Life Sciences, the team, along with Borski, includes fellow faculty members Harry Daniels and John Godwin. Adam Luckenbach, a doctoral student, has been working closely with the team for four years.

Though they jokingly refer to their work as "flounderology," they are serious about their science and its real-world applications.

"Aquaculture can be a lucrative alternative to tobacco farming," says Daniels, who eyes tobacco greenhouses as potential settings for growing Southern flounder in recirculating systems. Not suited for outdoor pond culture, Southern flounder do better in the warm, protected greenhouse environment.

The use of recirculating systems allays environmental concerns about wastewater discharge, Daniels adds.

Collectively, the close-knit team represents more than three decades of research experience. Their names turn up in literature reviews of aquatic research. Borski and Daniels, for example, are cited for showing that flounder can be raised in low- or no-salinity water; and Godwin, for his genetic studies of reef fish.

Daniels also is cited with Wade O. Watanabe, from the University of North Carolina at Wilmington, who worked with Daniels to develop successful Southern flounder hatchery protocols; and with Margie Gallagher, from East Carolina University, who is an expert in the nutritional aspect of flounder rearing. Their work laid the foundation for the team's temperature-induced sex determinant research.

Another familiar name that crops up in aquaculture citations is that of Ronald G. Hodson, director of North Carolina Sea Grant. Hodson is recognized as a pioneer in advancing hybrid striped bass from the research laboratory to successful aquaculture ventures.

In describing the flounder team's all-female stock breakthrough, Hodson says, "This research brings us one step closer to realizing profitable, large-scale aquaculture operations for Southern flounder."

Each step takes patience, he adds. "It has taken nearly a decade to develop successful Southern flounder hatchery protocols for rearing flounder from spawning to fingerling stage. This may be the breakthrough everyone was hoping for to ensure grow-out success from fingerling to market size."

Luckenbach says there are several advantages to a monosex female culture.

"Monosex female culture should reduce the size difference between individuals during the grow-out period, lessen mortality from cannibalism, decrease labor costs for size grading, and give a higher return on investment for feed and infrastructure," he explains.

Solid science basis

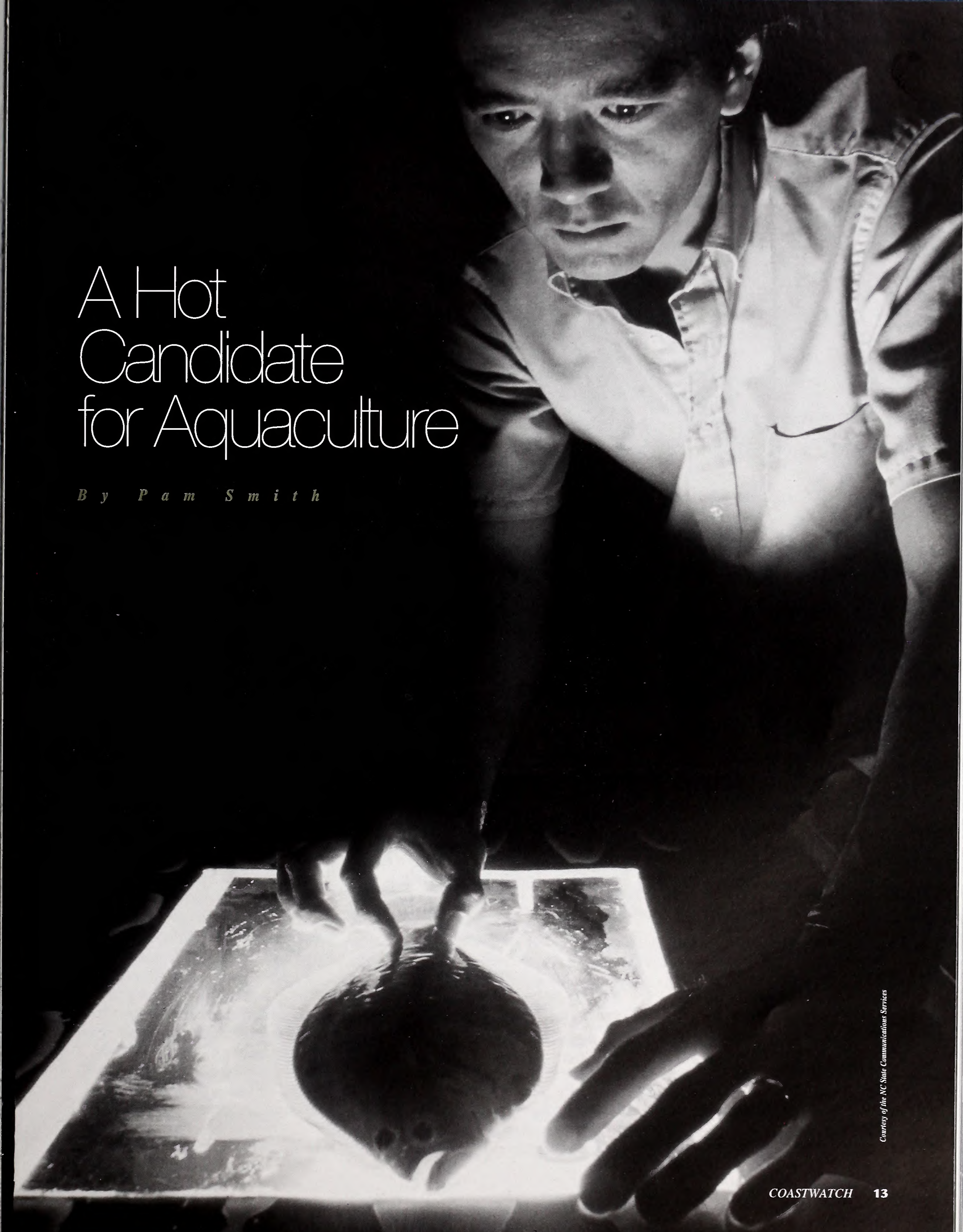
It takes solid science to develop and implement reliable, reproducible methods, the researchers point out. Their research results have been validated with the publication of peer-reviewed articles in major professional journals,

Continued

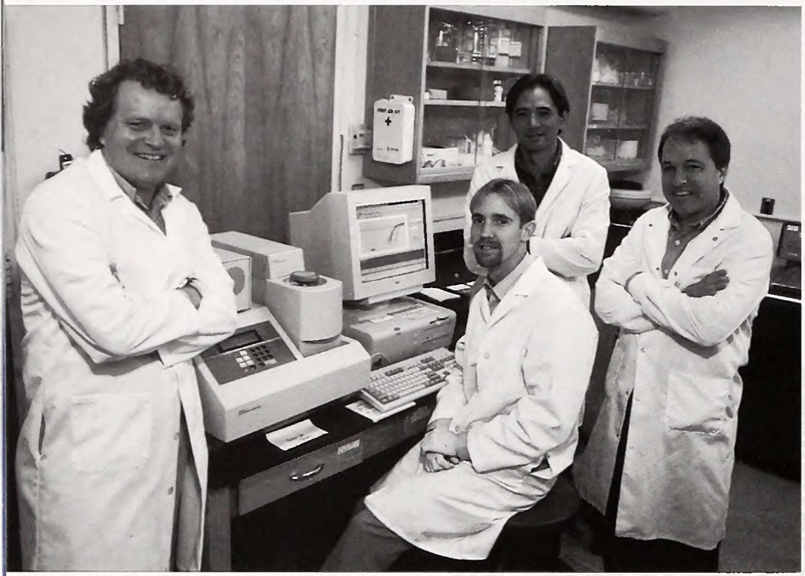
RIGHT: Harry Daniels examines a Southern flounder on a light table to determine its readiness for egg extraction.

A Hot Candidate for Aquaculture

By Pam Smith



Courtesy of the NC State Communications Services



Ken Taylor

The Southern flounder "dream team" test their scientific findings at North Carolina State University. The determined team members are (left to right) Russell Borski, Adam Luckenbach, Harry Daniels and John Godwin.

including *World Aquaculture* (March 2002), *Evolution and Development* (January-February 2003); and *Aquaculture* (January 2003).

The team has been invited to present their findings at the N.C. Aquaculture Development Conference in late January, and at both the Aquaculture America and World Aquaculture conferences later this year.

Importantly, their research has won respect and ongoing support from prestigious funding institutions, including North Carolina Sea Grant, the National Science Foundation, the National Institutes of Health, the National Marine Fisheries' Salstonstall-Kennedy Program, the Golden LEAF Foundation, as well as the NC State College of Agriculture and Life Science.

Still, the researchers are not resting on their laurels, Godwin says. In the coming months, they will challenge their own science to test methods and replicate results — and perhaps even streamline and refine procedures.

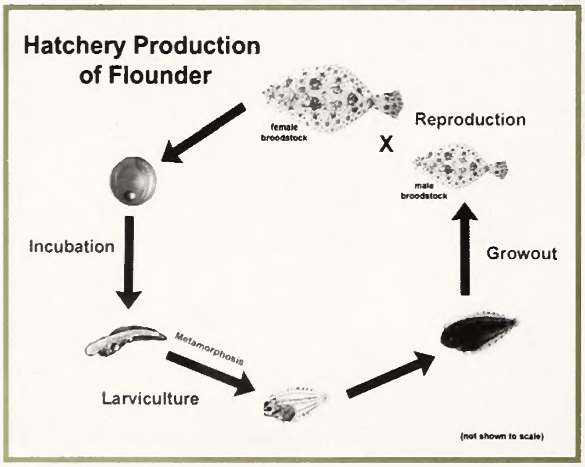
The first step is harvesting egg and sperm from wild-caught Southern flounder broodstock, using techniques developed by NC State colleagues Craig Sullivan and Hodson. Next comes fertilization and managing larval development to fingerling stage. This is where timing — and temperature — gets critical.

The team will re-examine their gynogenetic protocol to manipulate chromosomes to produce pure populations of Southern flounder XX female offspring on a large scale. They will incubate ripe eggs in ice-cold seawater to retain an extra X chromosome and then fertilize the eggs with ultraviolet-irradiated sperm (which destroys the chromosome contributed by the sperm) to produce pure populations of XX flounder.

When these fish are reared at the male-determining temperature of 28 C, XX males with functional sperm can be produced (Normal male flounder possess XY chromosomes.) These animals then can be bred with normal females to produce 100 percent female offspring when reared at the control or female-determining temperature (23 C).

The researchers will continue to probe the precise body size or developmental window of temperature-sensitive sex determination — and establish the critical body size at which temperature no longer alters the sex of the flounder.

In the coming months, they also will be considering the best methods for keeping larger fish healthy during grow out and examining the DNA of stock progeny.



Courtesy of the NC State College of Agriculture and Life Sciences

The protocol begins with crossing male and female broodstock. Larvae undergo a metamorphosis into bottom-dwelling flatfish.

Beyond economics

In the case of prospective large-scale commercial flounder farming operations, there are two sides to the economic coin. One side shows great promise as a farm-to-market economic success story. Fish farmers can provide year-round "crops" with consistent size, quality and flavor.

The other side of the coin holds economic potential for traditional commercial fishing as well. Reports of dwindling Southern flounder stocks by both national and state marine fisheries groups have resulted in more regulations and less profit for commercial fishing fleets.

In Japan, natural fisheries get a boost from the annual release of hatchery-reared juveniles.

Here, Southern flounder produced using the flounder project team protocols could be considered for stock enhancement without environmental concerns, the researchers say.

"These fish are not transgenic. We are not changing genes. They have the very same genes as their mothers," Borski says.

While the potential for using farm-reared fish for stock enhancement may be under scientific scrutiny, it is not on the National Marine Fisheries Service's policy agenda.

Popular fare

So, while the experts work out the most effective methods to protect and enhance fisheries stocks, there is little evidence that the demand for flounder will diminish any time soon. Health-conscious consumers are eating more fish as a protein source.

As it turns out, the Southern flounder may be too popular and versatile for its own good. Its delicate white filets have worldwide culinary appeal. The popular menu item can be dressed up as gourmet fare or served deep-fried with a side of slaw on a paper plate.

In the wild, Southern flounder share the life history "oddities" spotlight with other flatfish cousins. Most notably, their body shape changes and their eyes migrate to the dorsal side of their bodies during larval development.

Southern flounder are estuarine-dependent members of the left-eyed flounder family that includes summer flounder and Gulf flounder. Light to dark brown, they blend well into the bottom habitat they prefer. They are found in coastal waters from Virginia to Florida and in the Gulf of Mexico.

Southern flounder spawn in near-shore continental shelf waters from November through March.

Young fish enter inlets and settle on muddy bottoms in lower salinity areas of estuaries. They feed on small shrimp and fishes until they reach about eight inches, and begin to disperse into other available estuarine habitats. Capable of tolerating a wide range of salinity, they may inhabit brackish or freshwater streams.

Southern flounder are popular catches for commercial and recreational anglers alike. Consequently, the N.C. Division of Marine Fisheries has declared Southern flounder "overfished" based on recent stock assessments. The Southern flounder population in North Carolina, as reported in 2002, declined by 32 percent over the decade. A fisheries management plan is being developed.

"As a group, the flounder fishery is collapsing even with quotas and regulations. Regardless of restrictions, it doesn't appear that we ever will get back to historic stock levels without some help," Godwin points out.

Nature may need an assist from science. And, if stock enhancement through large-scale aquaculture does become an option, then the flounder team's novel research approach could be a promising path to follow.

Curiosity and tenacity

But just how did the idea for developing protocols for monosex stock evolve from concept to methodology?

A good scientist is a complex animal — comprised of intellect, curiosity, creativity and tenacity. And, as Hodson suggested, patience.

As good scientists should, they began with a methodical review of the literature. They came away in awe of "how little we know about a fishery that is worth millions," Godwin recalls. "There were data on temperature effects on sex, but the theories were not widely held or tested."

Feeling it was worth a more thorough look, the team requested English translations of abstracts written by Japanese colleagues. It was the beginning of their age of enlightenment about the dynamics of sex determination.

In 2000, then Sea Grant Fellow Joanne Harcke traveled to Japan to learn about Japanese flounder rearing in hopes of adapting some of their successful techniques to Southern flounder culture.

Meanwhile, the research team began testing the temperature theory with a "what if" approach.

The flounder project has all the hallmarks of the triple mission of a land grant university — research, teaching and outreach.

Team members confer with premier fish scientists from around the world to share research findings and expand their own knowledge. Closer to home, they collaborate with researchers from NC State and sister universities, state and national agencies, and industry representatives.

The research project has been an educational opportunity for students, Daniels points out. Harcke, one of his students, has gone on to become a research coordinator for the N.C. Aquarium on Roanoke Island, and continues to consult internationally on flounder development.

Luckenbach has co-authored research articles published in major journals and will base his doctoral thesis on the work. He recently presented his research findings at international scientific meetings in Bergen, Norway, and Florida.

While a student at Raleigh's Enloe High School, Jessica Beasley worked with the research team. Her accomplishments won her an American Junior Academy of Science Award in conjunction with the American Academy for the Advancement of Science. Beasley now is a student at NC State.

Courtesy of the NC State College of Agriculture and Life Sciences

The ability to rear Southern flounder from hatchery through grow-out will open a new aquaculture market.

Sharing knowledge is an important dimension of their work. Often, opportunities come to them. This year, Aiko Ueda, a master's degree candidate from Japan, is studying with the NC State flounder team. And visiting scientists and students from the University of Southern Denmark in Copenhagen are in residence on the main campus this semester.

Recently, officials from Indonesia on a U.S. study tour visited the fish barn/laboratory at the NC State's Lake Wheeler Research Station.

At the Lake Wheeler facility, Daniels leads the work on refining the Southern flounder hatchery process that takes larvae to the fingerling stage. A new grant from the Golden LEAF Foundation will underwrite the construction of a building to house a flounder breeding facility. The hatchery/grow-out aquaculture complex will be the state's first for Southern flounder.

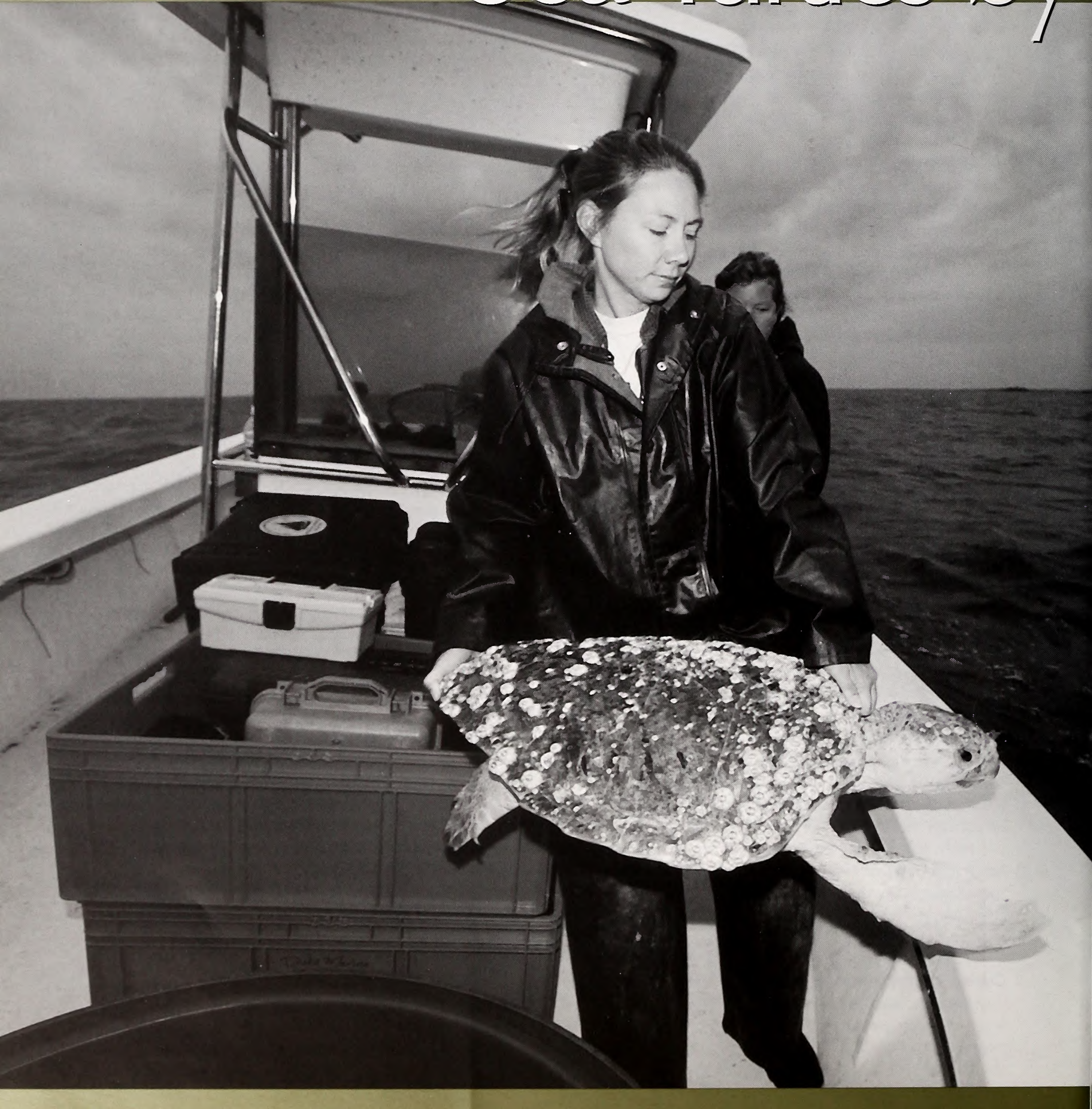
The researchers confer regularly — Tuesday at 10 in Godwin's lab. Thursday at 10 in Borski's lab. And every other Wednesday at Daniels' Lake Wheeler hatchery.

What's the driving force? Perhaps, commitment mixed with national pride.

"The U.S. is not among the world's top ten aquaculture producers. Japan is way up there. China is blasting us out of the water. And developing nations are leading us," Borski says.

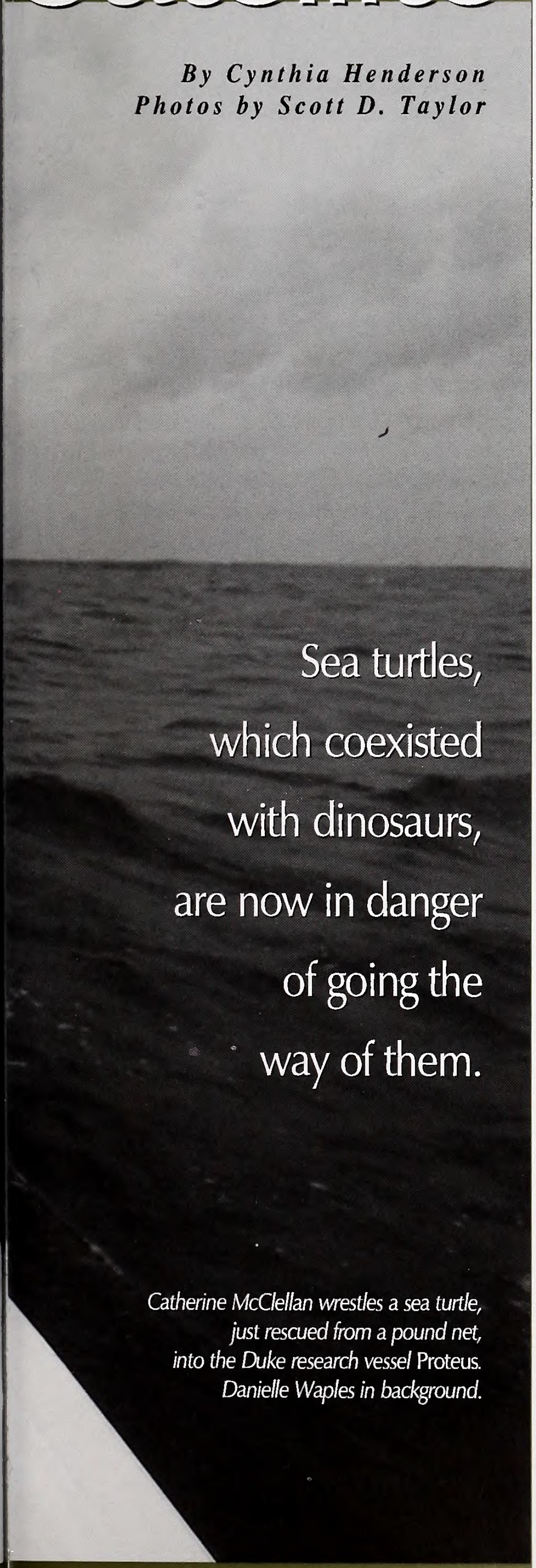
He and his colleagues are determined to help push the United States into a leading position in the world aquaculture market. ▣

Sea Turtles by



Satellite

By Cynthia Henderson
Photos by Scott D. Taylor



Sea turtles, which coexisted with dinosaurs, are now in danger of going the way of them.

Catherine McClellan wrestles a sea turtle, just rescued from a pound net, into the Duke research vessel *Proteus*. Danielle Waples in background.

Catherine McClellan and Danielle Waples have been going out in the dark to meet men they don't know in places they've never been before. At least, that's their joke about what they do.

Since September, McClellan, research specialist with the Duke University Marine Lab in Beaufort, and colleague Waples, have been meeting pound netters in the Pamlico Sound at unseemly hours hoping to find what many dread — sea turtles in fishing nets.

Usually, that kind of event puts net fishers at loggerheads with fisheries regulations, and sea turtles in danger of their lives. But in this case, the outcome can be fortunate for both.

That's because McClellan is involved in finding ways to predict turtles' movements to keep them out of fishing nets in the future. It's research that joins prehistory with space-age technology as sea turtles — reptilian refugees from the age of the dinosaurs — are tagged with satellite transmitters.

It started with a grant awarded to commercial fisher Bill Foster of Hatteras, and Andy Read, marine scientist at the Duke lab.

"Such academic/fishing industry partnering is a hallmark of the N.C. Fishery Resource Grant program, which combines real-life fishery experience with scientific research," says North Carolina Sea Grant Director Ronald G. Hodson.

The project is "a window into the lives and movements of sea turtles that we've never had before," Read says.

"It's very rare to be able to follow enough animals to be able to make sense of their movements," explains Read. "Turtles are very idiosyncratic. If you look at only a small number of the animals, it may not be representative of all turtles."

By the study's end, 45 turtles will have been tagged. McClellan conducts the study with Waples as a regular field assistant.

When sea turtles interact with fishing nets, it's normally a lose-lose proposition. Sea turtles caught in fishing gear drown if unable to surface for air. And when fisheries are implicated in turtle deaths, or when observed interactions exceed the limits established by the National Marine Fisheries Service (NMFS), fisheries can be shut down. The federal Endangered Species Act prohibits any "takes" of sea turtles by humans, McClellan says.

By tracking sea turtles' movements, researchers hope to find ways to prevent deadly interactions between turtles and fishing gear.

In 1999, more than 70 dead turtles washed up along sound-side beaches of Ocracoke and Hatteras islands in a mass "stranding." The N.C. Division of Marine Fisheries and NMFS determined that the large mesh (greater than five inches) flounder gillnet fishery was a likely cause, although no net marks were visible on the turtles, which appeared to be healthy prior to death.

Both agencies prepared an Incidental Take Permit as a way to keep the gillnet fishery open in the future. But the fishery was closed again in 2000 when limits for strandings and "incidental takes" were exceeded, says Jeff Gearhart, marine biologist with the DMF.

Shrimp trawls were active in the Pamlico when the strandings occurred, but they are equipped with turtle excluder devices, or TEDs, as required by law. TEDs propel turtles out of the trawl nets, says Gearhart. "The devices they use here have been tested by NMFS," he explains. Tests must show that 97 percent of turtles entering a device are ejected out of it.

Yet the success of the devices is not entirely clear, according to Matthew Godfrey, coordinator for the state's Sea Turtle Project of the N.C. Wildlife Resources Commission.

"Theoretically, mortality has dropped," he says of the shrimp fishery. "But TEDs don't always work. The same turtles can be caught several times a day, and that stress can cause death."

The Sea Turtle Dilemma

Sea turtles, which coexisted with dinosaurs, are now in danger of going the way of them, according to McClellan.

All five species found in North Carolina waters — the green (*Chelonia mydas*), loggerhead (*Caretta caretta*), Kemp's ridley (*Lepidochelys kempii*), leatherback (*Dermochelys coriacea*) and the Atlantic hawksbill (*Eretmochelys i. imbricata*) — are protected by law. All are classified as endangered except the loggerhead, which is considered threatened — and its status may change to endangered, as well.

The most common sea turtles in the state — and the ones included in the study — are the green, Kemp's ridley and loggerhead.

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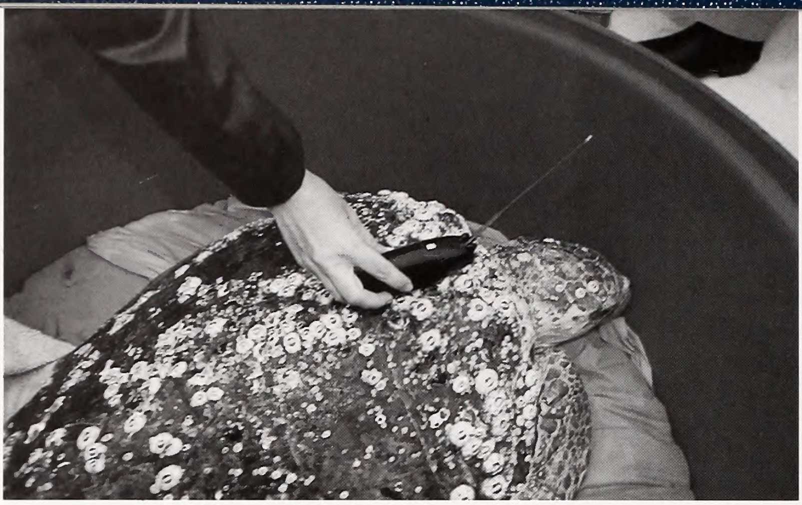


Of the four families of sea turtles to emerge from the Cretaceous Period 65 to 70 million years ago, two families remain — the *Dermochelyidae* with its single member, the leatherback, and *Cheloniidae*, the hard-shelled sea turtles. All of them are now considered either endangered or threatened.

Meanwhile, some feel livelihoods are being threatened by regulations that protect turtles. Foster, who currently works under contract with NMFS on the Marine Mammal Take Reduction Team, says, "It would be difficult to find any commercial fisherman who believes there's a shortage of turtles, just because they're getting more and more of them."

"Most fishermen have nothing against turtles," says Foster, "but sometimes it's hard for them to see the justification" for closures.

"Sometimes it doesn't make sense why they close one area when they know there are turtles in other areas, too," Foster explains.

Godfrey says it is possible that there are more strandings reported because there are more turtles. "The increases can also be due to more people looking," he says.

Evidence linking the 1999 mass stranding to the flounder fishery was circumstantial. But, says Godfrey, "the fishery started up and within a week there was a huge stranding event. ...That's pretty good evidence."

Gearhart speaks of the difficulties of accurate population assessments. "Anecdotally, from what people on the water are telling me, they're seeing more. It makes sense, because we're protecting them," he says.

"It's a real 'Catch 22' for our fishermen. The more we protect, the more there are. And the more there are, the more will be caught," says Gearhart.

Total strandings for 1999 were 605 turtles. In 2000, the number rose to 888 and dropped to 361 for 2001, according to data supplied by Godfrey.

Numbers of turtle strandings fluctuate each year, Godfrey says. But, he adds, "Whether there are 500 or 800, they're all too high."

McClellan agrees. Regardless of what the actual population of sea turtles is, she explains, it is unlikely that losses that high can be sustained without irreparable harm.

In the Field, On the Water

For McClellan, a typical day of fieldwork begins the night before when she calls pound net license holders to ask if they will be going out the next day and if she can accompany them.

A frequent response is "hesitation," she says.

It can take many attempts to coordinate fishing trips with research. From calls to nearly 50 fishers, the team has gone out with fewer than 10 — but McClellan says the research team has accompanied some boats multiple times.

It's a go on a particular fall evening when Howard Gaskill, commercial fisher and ferry worker, agrees to allow the researchers to follow him and his brother, Kenneth, to their pound nets the next morning.

The study is designed to coincide with the flounder gill net fishery, says McClellan, but pound nets, which impound turtles while allowing them to surface for air, are more likely to yield turtles alive and in condition suitable for tagging.

At the Duke lab, the research vessel *Proteus* is hitched to a truck and ready to go by 5:30 a.m. Fishers won't likely wait for tardy researchers.

There is, perhaps, an ominous feel to the cool, drizzly darkness, but to Waples and McClellan, it seems to be just another day in the field. Later, when the water is choppy and the drizzle gives way to intermittent rain, the two will keep queasiness at bay with Goldfish — crackers, that is. Preparedness pays.

Out past a spoil island — a byproduct of dredging — near where the Pamlico gives way to Core Sound, the Gaskills reach the first net. Howard, thumbs up, yells, "We've got a turtle."

McClellan wrestles the loggerhead, which appears to be at least half her own weight, aboard the *Proteus*. The turtle goes into a circular, foam-lined blue tub, and McClellan begins her assessment with Waples recording data.

The researchers pronounce the turtle a "virgin," bearing no preexisting tags. McClellan confirms this by scanning the turtle with a Starship Enterprise-type device. The scanner would detect implanted PIT tags, or passive integrated transponders, which carry identification from previous encounters with researchers.

To the uninitiated, the creature in the tub is — wow — a sea turtle. McClellan sees more. It's not moving enough, and it has so many barnacles, that McClellan suspects it has been lethargic for some time. She describes it as skinny and pale.

This turtle will not be tracked by satellite, will not sport a $2,000 transmitter. McClellan confers with Godfrey, who personally will deliver the lethargic loggerhead to the Karen Beasley Sea Turtle Rescue and Rehabilitation Center at Topsail Beach.

But first, while still on board the *Proteus*, McClellan follows a NMFS protocol, including placing a PIT in a front flipper, and metal tags on both rear flippers.

Measurements are made by McClellan and a biopsy is taken from a flipper for genetic studies. A blood sample from the turtle's neck will determine its sex.

There is no sure way to tell a juvenile turtle's sex by looking at it, McClellan explains, but she gives a large-ballpark figure for its age. "Little turtles stay in the ocean until between 10 and 14 years old," before returning to the sound. This one's age is probably between 14 and 30, she says.

Loggerheads lay eggs on North Carolina beaches. When discovered, nests are watched over by volunteers with the N.C. Turtle Project. Hatchlings find their way to the ocean and navigate using cues such as "celestial bodies (i.e., light)...silhouettes, waves and currents, and magnetic fields," McClellan explains.

"The babies go out to the Gulf Stream for an undetermined period of time," says McClellan.

But where specifically they go — and what

they do there — evokes what is a common answer to many questions about sea turtle migration.

"We don't know," McClellan says. "They're called the lost years. Nobody knows for sure where they go or how far they go."

No one knows why so many turtles interact with flounder gill nets, but McClellan hopes to find out.

"It is likely that temperature is causing both turtles and flounder to be migrating that time of year. It could be they're both migrating out of the estuary."

"They may just go offshore, south, or to the Gulf Stream," McClellan explains. "There is evidence that an individual will come back to the same area each year."

Understanding turtle migration is key to making regulations that are more specific and protect both turtles and fisheries.

But why spend so much energy protecting sea turtles when, in an economically depressed part of the state, people's livelihoods can be at stake?

There are issues of biodiversity and "ecosystem function," McClellan notes.

"We don't know enough about how (sea turtles) are using the habitat and what it would look like without them," she adds.

"Certainly everyone has different opinions, and so we resort to thinking about 'viable population sizes,' " McClellan says.

Ultimately, the problem of accidental takes of sea turtles in fisheries might be too complex for numerical equations.

"Accidents happen, and, when turtles and fishers use the same area for different purposes, there are bound to be interactions," McClellan adds. "But we need to be responsible in understanding and controlling these interactions, and that's what I think this project and the efforts of NMFS and DMF, the Wildlife Resources Commission and, indeed, some of the fishermen are trying to do." ◘

PHOTOS, LEFT TO RIGHT:

- *The satellite transmitter as it would be affixed to a healthy sea turtle. The antenna is flexible, and signals are transmitted when the turtle surfaces for air. This turtle, later dubbed "Catherine," is destined for the turtle hospital.*
- *Catherine McClellan follows a NMFS protocol for routine tagging and sampling of sea turtles.*
- *McClellan takes carapace measurements.*
- *Volunteers care for sea turtles at the Karen Beasley Sea Turtle Rescue and Rehabilitation Center.*
- *At the turtle hospital, Sandy Sly cares for Catherine, the sea turtle. Director Jean Beasley in background.*

Topsail's Turtle Rehab

It's controlled chaos and cacophony at the turtle hospital. And it happens every day.

Jean Beasley, founder and director of the Karen Beasley Sea Turtle Rescue and Rehabilitation Center explains what is happening.

It's bath time for the 12 patients — one green, one Kemp's ridley and 10 loggerheads. Volunteers drain and disinfect the basins, bathe the turtles, give medications and tend wounds. Then they refill the basins with seawater that has been warmed to around 76 degrees in tanks behind the hospital on the sound side of south Topsail Beach.

In a corner of this tight, humid room with a wrap-around undersea-theme mural, is a tub labeled "Catherine." Despite the similarity, Catherine the turtle is not named for Catherine McClellan, the researcher who sent the turtle here. It turns out the spoil island near where the turtle was found is known as St. Catherine's Island, according to Beasley.

"We never name them for people," she says. "They are named for places or life events — not pet names. The names tell what happened to them or what needs to be done."

Beasley says Catherine's prognosis is good, but she has a poor appetite and is still quite sick. She probably aspirated, or took water into her lungs when caught in a net. Her breathing rattles, and she is getting Fortaz, an antibiotic — but the drug is getting scarce since the hospital lost its supplier. Drugs can be given to the turtles up to a year after expiration for human use.

Other turtles have visible injuries. Abott had a gangrenous front flipper from being trapped in a net. And he had ingested a foot-long piece of the fishing net that had trapped him. The flipper was amputated at North Carolina State University College of Veterinary Medicine. Greg Lewbart and Craig Harms of NC State are consulting doctors for the hospital.

Honey has a lateral gash in the upper shell, but her injuries were much more severe. She was dropped 12 feet from a fishing net to a boat deck, and her plastron, or undershell, was ruptured. She required surgery, but is recovering nicely.

Bay, a green turtle, is languidly eating lettuce. He was hit by a boat propeller and caught in a net. Air trapped under his shell keeps his rear suspended peculiarly in the water.

"The fisherman called at 6 a.m.," Beasley recalls. "He gave up a day of fishing to bring the turtle in."

While many injuries are caused by commercial gear, Beasley credits the fishers who bring turtles to the hospital, and cautions against "living in a glass house."

"Unless you can say you're doing everything you can to protect the environment," she says, "you can't throw stones."

The turtle hospital has existed for five years, says Beasley, "with one and a half years of 'turtle MASH' before that." At that time, sick or injured turtles were taken to Florida for treatment, she says.

The hospital is staffed entirely with volunteers and funded through donations.

For more information or to follow case histories of the turtles, go to www.seaturtlehospital.org *or write: Sea Turtle Hospital, P.O. Box 3012, Topsail Beach, N.C. 28445.* — C.H.

Scott D. Taylor

Coastal management, including dune preservation and public access, was a major topic for Indonesian officials visiting North Carolina.

Beyond the Boundaries:

Indonesian Officials Take Home Coastal Lessons

By Katie Mosher

Surf City on Topsail Island is a long way from the beaches of Bali, or any of the 17,500 islands that make up Indonesia.

But lessons learned along the North Carolina coast will factor in discussions this year in Indonesia, where pivotal coastal legislation is being considered.

"Good coastal management is important to us all," Surf City Mayor Zander Guy suggests to a pair of senior Indonesian officials on a recent visit hosted by North Carolina Sea Grant.

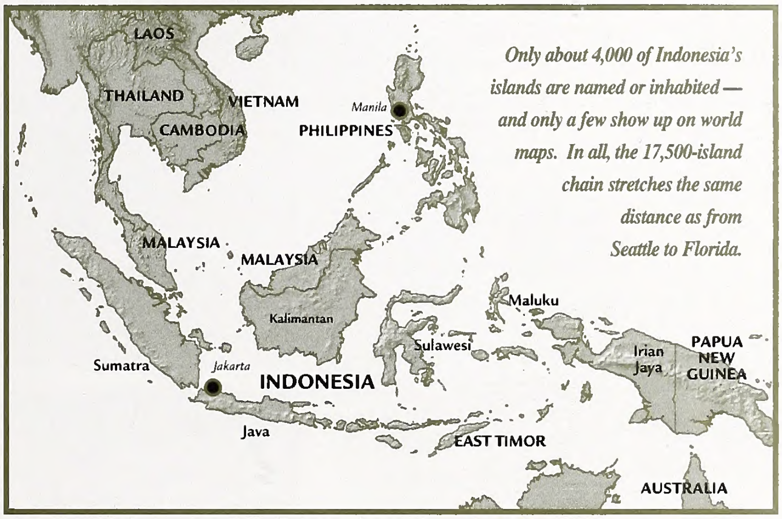
The Indonesians chose to visit North Carolina because of the state's "robust and dynamic" coastal programs, explains Soestrisno Sosroprajitno, vice chair of the National Parliament's Environmental Commission.

The trip halfway round the world is fruitful, says Widi Pratikto, Indonesia's director general of coasts and small islands in the Ministry of Marine Affairs and Fisheries.

"In Indonesia, we are trying to establish our own 'Sea Grant' Program called *Program Kemitraan Bahari* (Sea Partnership Program). Our visit to Hawaii, North Carolina, Washington, D.C., Rhode Island, and Halifax, Nova Scotia, strengthens our belief that through such a program, we will succeed in developing our nation's coastal ocean programs in order to achieve economic development in sustainable ways," he adds.

Pratikto is already familiar with North Carolina, having received his doctorate in civil engineering from North Carolina State University in 1992. His coastal research here focused on natural approaches for mitigating dune erosion.

For the past year, he has led a variety of efforts in his home country, including integrated coastal management, small islands management, coastal spatial planning, marine conservation, economic development and empowerment within coastal communities.



Only about 4,000 of Indonesia's islands are named or inhabited — and only a few show up on world maps. In all, the 17,500-island chain stretches the same distance as from Seattle to Florida.

He works closely with the Indonesia Coastal Resources Management Project (CRMP). A joint project of the Indonesian government and the U.S. Agency for International Development, CRMP is implemented by the University of Rhode Island's Coastal Resources Center.

"We have learned a lot about local coastal zone management in different places, such as Hawaii and North Carolina," he says. Topics include how to utilize "set backs" and "retreat" methods.

"We now are more convinced that through decentralization of control over coastal resources, our coastal beaches will be managed in better ways," he adds. "However, we can be successful only by increasing the capacity of our government staff, coastal residents and citizens and nongovernmental organizations, etc."

SCIENCE AND POLICY

Sosroprajitno, who received his doctorate in agricultural economics from the University of Hawaii, explains that he offers a dual perspective.

"I have two feet – one in science and one in politics," he says. As vice chair of the commission in parliament that includes marine affairs, he will lead much of the debate on new coastal legislation.

Blending science and policy is a challenge for Indonesia. After decades of authoritarian rule, the Indonesian Parliament is moving the country toward a decentralized government.

The political changes are not so dramatic in North Carolina. But, connections between science and policy decisions are equally important here.

"Regulatory agencies benefit from working with university researchers. Sea Grant provides that critical link through education and outreach programs," says Walter Clark, Sea Grant's coastal law and policy specialist.

That format is a model for many countries. "Having a Sea Grant Program will be nothing short of phenomenal in Indonesia," says Maurice Knight, director of CRMP.

The U.S. tour reveals that while Sea Grant and Coastal Zone Management are national efforts, states must develop programs that respond to unique needs.

"Indonesia is very eager to begin these types of local management approaches," says Stacey Tighe, CRMP senior technical advisor.

Indonesia has the second longest coastline in the world with 82,000 kilometers of coast. More than 60 percent of Indonesia's 220 million people live within 50 kilometers of the coast.

The country's vast marine resources include more than 70 genera of hard corals – and the island chain is touted as the "bull's eye" of highest marine biodiversity on earth. However, only about 7 percent of Indonesia's coral reefs are considered in pristine condition.

About 24 percent of Indonesia's gross domestic product comes from marine products and industries. As traditional forest resources are depleted, emphasis is shifting to marine and coastal resources.

N.C. ITINERARY

On Topsail Island, the Indonesian group meets not only with the Surf City officials, but also with representatives of the N.C. Division of Coastal Management (DCM). Topics include erosion rates and setbacks, even storm-related emergency policies.

Public access is another focus, both on the oceanfront and along the sounds that are experiencing increased development. "Communities are buying tracts of land for everyone to enjoy," explains DCM's James Rosich as the group stops at a newly designated soundfront park in Surf City. "Access is a priority," he adds.

The Indonesian officials are interested in the "public trust" doctrine that supports many coastal management decisions here. Indonesian islands increasingly are being eyed by outside investors looking to develop shrimp farms or to establish scuba diving and adventure travel outposts.

Coastal economic development opportunities – and challenges – are the topics during stops in Morehead City and New Bern.

The visitors meet Don Cross of Pamlico Packing, who is working with Sea Grant to develop "value-added" products in addition to the traditional seafood commodities. The group also samples new seafood dishes tested in the NC State Seafood Laboratory with volunteers known as Nutrition Leaders.

Penny Hooper, who leads the mariculture program at Carteret Community College, describes the sequence that trains students for either immediate entry into the aquaculture industry or for further education. She also has many questions for the guests. "I am in awe of the task they have ahead of them," Hooper says.

"They recognize that education is an important part of any of their projects," she adds.

"And that the keys to sustainability for seafood are good regulations – and aquaculture."

Continued

The group then heads to Smyrna to see Mark Hooper's shellfish mariculture operation that utilizes the state's program to lease bottom areas of Core Sound.

The group discusses fishery issues with Preston Pate, director of the N.C. Division of Marine Fisheries (DMF), and Jerry Schill, president of the N.C. Fisheries Association.

Schill cites the Sea Grant role in reducing bycatch in shrimp trawls. Sea Grant worked with the fisheries association and the DMF to develop and test "bycatch reduction devices," known as BRDs, well ahead of other states.

"The fishermen started using them – and the BRDs worked," says Schill, who noted the wide acceptance because the fishing community was involved. Eventually the state required the gear already in use.

The tour concludes in Raleigh, including a visit to the NC State "Fish Barn," an aquaculture facility that provides scientific groundwork for Sea Grant recommendations to industry. On campus, they meet with civil engineering faculty to learn the latest in coastal engineering.

The group then heads to Washington, D.C., to meet with National Oceanic and Atmospheric Administration officials, including Ronald Baird, director of the National Sea Grant College Program.

CONTINUED CONNECTIONS

Each stop on the tour offers lessons not only for the Indonesian Parliament, but also for government agencies and universities.

Russ Lea, vice president for research for the University of North Carolina system, explains that university extension provides immediate access to the latest information. "The universities are where the action is," says Lea, who met with the Indonesian officials.

"There's a rapid transfer of knowledge through the extension program to the stakeholders – right as the scientific breakthroughs are being generated," he adds.

The direct connection encourages an enthusiasm among coastal partners in North Carolina that is "infectious," says Tighe. "To see the strong role of advisory boards and citizens councils and volunteerism makes a real impression of how stakeholders can be involved in governance," she adds.

And the international exchange is likely to continue.

"We already have had discussions of potential cross visits and new partnerships that will surely evolve into strong, formal and hopefully mature networks over the years ahead – as the stewardship of people and the ocean planet bring families together with common interests," Tighe says.

Ronald G. Hodson, North Carolina Sea Grant director, adds that the experience is a two-way street.

"We learn as they explain the challenges – and opportunities – that Indonesia is facing," Hodson says. ▣

TOP TO BOTTOM:

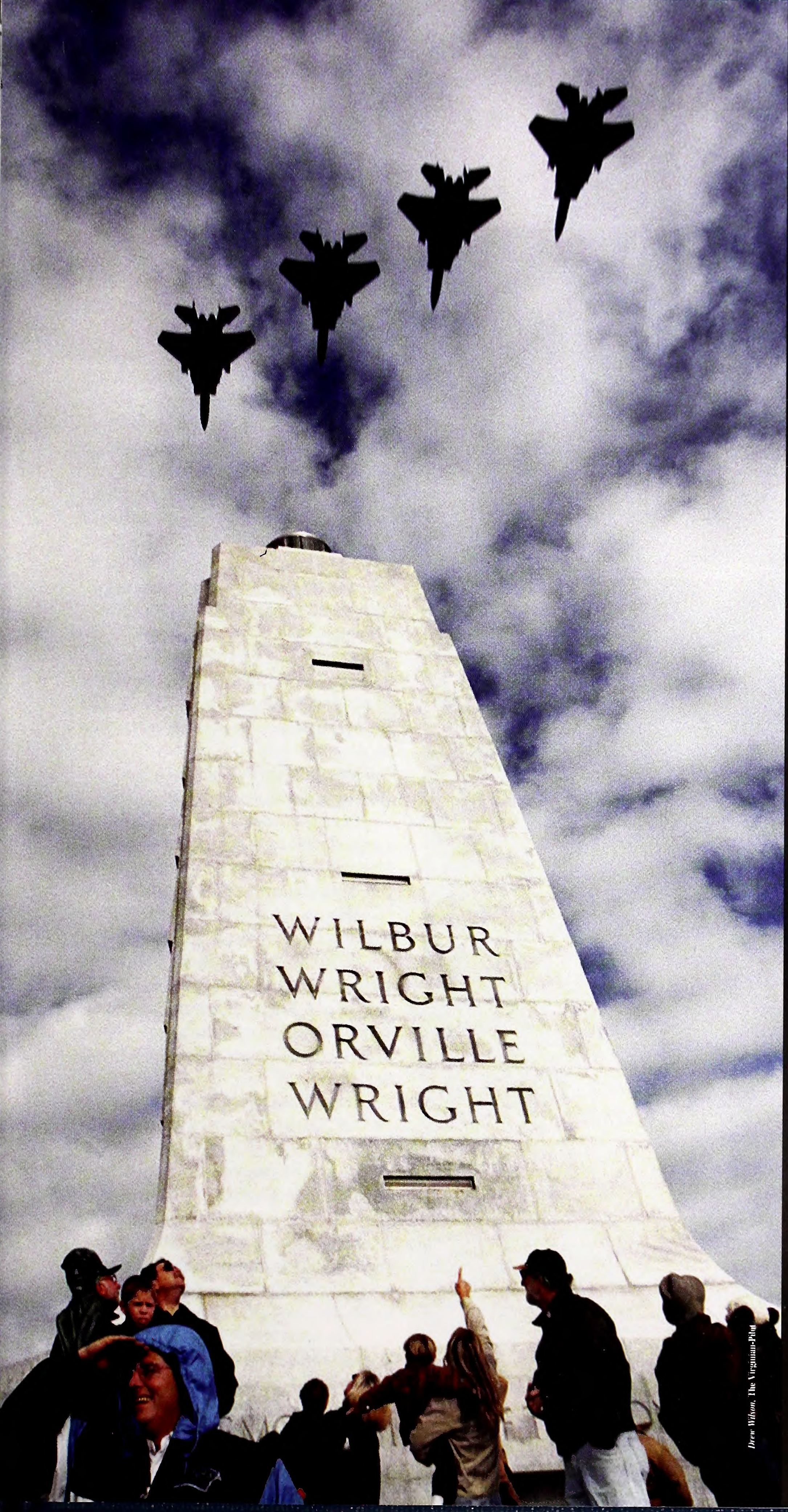
- *Sea Grant researcher Harry Daniels, right, describes flounder aquaculture to Soestrisno Sosroprajitno, a member of the Indonesian Parliament, left, and Widi Pratikto, Indonesia's director general of coasts and small islands, center.*
- *Caroline Bellis, of the N.C. Division of Coastal Management, discusses setback rules with, from left, Walter Clark, Widi Pratikto, James Rosich and Maurice Knight.*
- *Penny Hooper of Carteret Community College, center, explains clam mariculture to Widi Pratikto, left, and Soestrisno Sosroprajitno, right.*
- *Surf City Mayor Zander Guy welcomes Indonesian officials to Topsail Island.*

Sherri Thomas

Scott D. Taylor

Scott D. Taylor

Katie Mosher

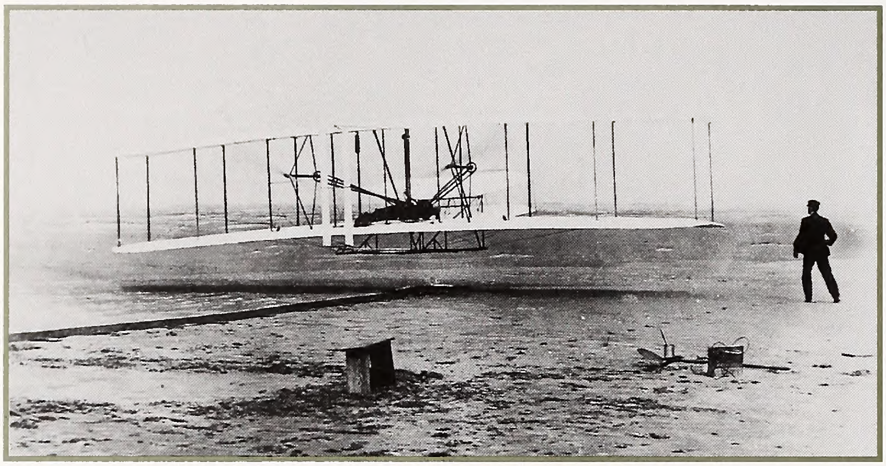


Drew Wilson, The Virginian-Pilot

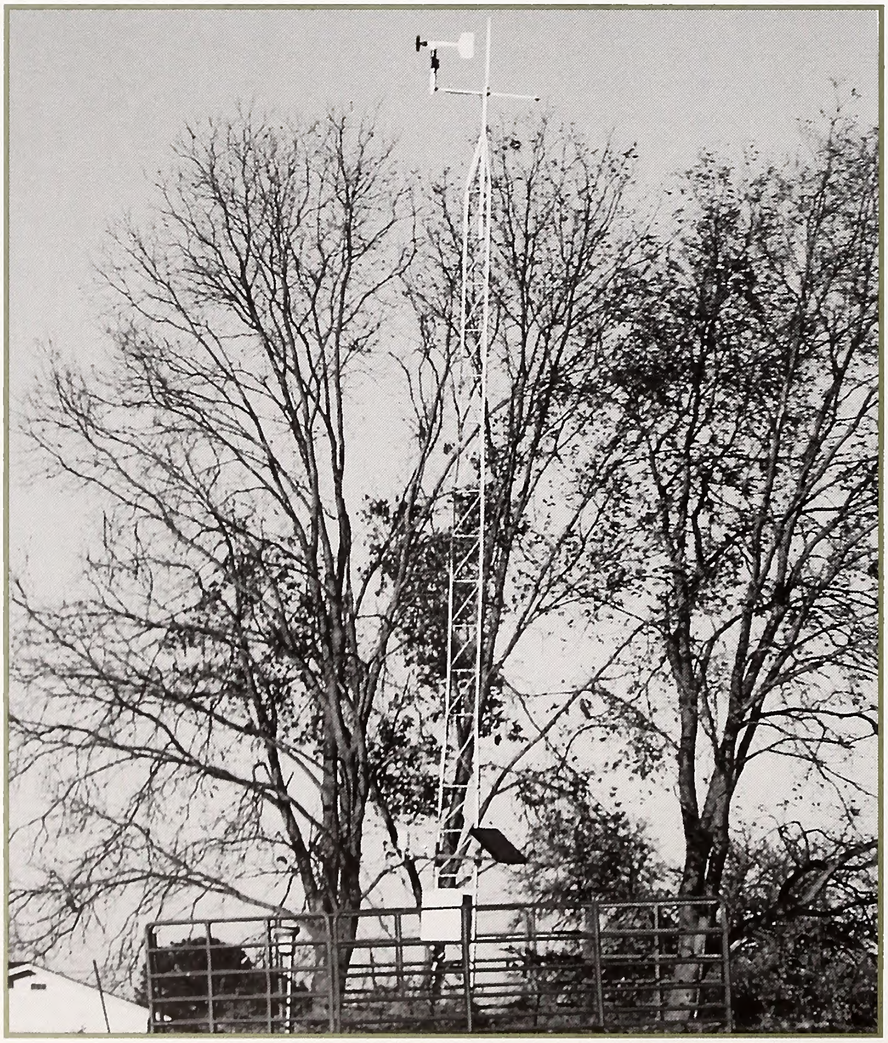
Outer Banks' Wind Field Helped Propel First Flight

By Ann Green

Continued



Courtesy of the N.C. Office of Archives and History



Ven Carver

TOP: The Wright Brothers made their historic flight at Kitty Hawk.
BOTTOM: This NC ECONet weather station in Raleigh is one of many across the state.

Before the Wright Brothers took off on Dec. 17, 1903, the air was bitterly cold — 8 degrees with the chill factor, according to Wright Brothers National Memorial historian Darrell Collins.

"There also was a nor'easter that morning with winds blowing from 27 to 30 miles per hour," Collins says.

With the steady winds tearing down the coast, the brothers made history at Kitty Hawk with the first sustained flight in the air.

What caused the windy conditions in December?

There was probably a low-pressure system in the area, according to Len Pietrafesa, director of external affairs in the College of Physical and Mathematical Sciences at North Carolina State University.

"December, January and February are the most active months for nor'easters on the Outer Banks," adds Pietrafesa, a former North Carolina Sea Grant researcher. "During a nor'easter, winds can get up to 70 mph."

Throughout the year, windy conditions are commonplace along the Outer Banks.

One reason for the high winds is the large amount of water around the area, including the Albemarle-Pamlico Estuarine System — the second largest estuary in the United States.

When wind hits land, the friction of trees and vegetation usually slows it down, says Pietrafesa.

"However, the barrier islands are so narrow that the wind field doesn't recognize them as land," he adds. "The wind is generally 1 1/2 times to 2 1/2 times larger in magnitude on the Outer Banks than on the western side of the Pamlico Sound."

During December 1999, the maximum wind speed at Cape Hatteras was 41 mph compared to 20 mph at Castle Hayne near Wilmington, which is only a mile from the ocean, according to the National Weather Service.

Wind speed doubles as it blows from land to the ocean, says state climatologist Sethu Raman. The reverse happens when wind blows from ocean to land, decreasing the speed by half as it reaches land.

"The wind stress — what creates the lift and forces an airplane up — is also 2 1/2 to 6 times larger at the Outer Banks than on the mainland," says Pietrafesa. "This contributed to the Wright Brothers' robust and effective wind field."

EXTRATROPICAL FORMATIONS

Another reason for the high winds is that extratropical cyclones or midlateral storms are further intensified and can form off the North Carolina coast, particularly Cape Hatteras. Pietrefesa and Raman have conducted studies on the storm formation processes.

When the cold air comes down from Canada, it cannot move west because of the mountains. You also often get warm moist air from the Gulf Stream.

If the conditions are right, gravity pulls cold, heavier air under warmer, lighter air, according to USA Today's *The Weather Book*.

"Contrasts between warm and cold air have potential energy. When something happens to start warm and cold air masses moving over and under each other, their potential energy becomes a storm's kinetic energy," the book explains.

"Storms can form in 15 to 30 hours off the Outer Banks," says Pietrafesa. "These storms can create a strong wind field."

While global winds determine the weather over a large area, smaller winds can create other weather changes.

One of the most common local winds is a sea breeze along the ocean.

"During the summer, sea breezes blow from the south to north at an average of 5 to 10 knots," says Pietrafesa. "Winter sea breezes typically blow from north to south from 10 to 20 knots."

WIND AND RECREATION

Along the Outer Banks, recreational activities are often defined by wind.

"The best surfing waves are sculpted by a northeast blow that shifts cleanly to the west," according to Jan DeBlieu's *Wind*.

"But if the west wind blows too long, the breakers are knocked flat. Surfers disappear, replaced by commercial fishermen, who row dories just offshore to set their nets for bluefish and trout."

Locals have their favorite winds, according to DeBlieu:

Outer Banks surf casters like a land breeze, because as they say,

Wind from the east, fish bite the least.
Wind from the west, fish bite the best.

"A westerly breeze draws trout, mullet and other species to the calm waters in the lee of the shore. During duck hunting season it also pushes waterfowl from the middle of the Pamlico Sound toward the islands, putting them in easy range of hunting blinds."

During the summer, light easterly winds slow along the barrier islands, says DeBlieu.

"West winds muddy the ocean waters, but east winds clear them," she wrote. "West winds bring biting flies to the beach, but east winds banish them to the north. The most pleasant summer days are those with an ocean breeze strong enough to set up a little surf, but not so strong as to make swimming dangerous."

FORECASTING WIND

Over the years, wind technology has become more advanced. Meteorologists now use a wind sensor to measure speed and direction. During rainy weather, they use doppler radar to measure the winds off the ground.

"Doppler radar is the most important development in weather technology," says Raman. "It can even spot a small tornado. It can detect winds up to several kilometers."

To improve local weather information and forecasts in North Carolina and create a database for future research, the State Climate Office, in cooperation with federal and state agencies, has initiated the development of the North Carolina Environment and Climate Observing Network (NC ECONet).

When completed, the network will have at least one automated weather station in each North Carolina county.

Data from these stations will be provided to government agencies to improve emergency management, weather forecasts, energy planning and natural resource management. Data also will be made available in "realtime" to the general public.

"We are using it to get the average wind speed," says Raman. "When the whole system is up, it will provide information to predict droughts and improved planning for tourists who want weather information from beaches to mountains. With improved forecasts, it can save the state $91 million."

To find about more about ECONet, visit the Web: www.nc-climate.ncsu.edu.

For more information about the First Flight Centennial Celebration at the Outer Banks — which culminates with a celebration Dec.13-17 — go online to: www.outerbanks.org.

Flying Fundamentals

WANT TO KNOW ABOUT THE BASICS OF FLYING?

As the curved wings of airplanes go through the air, the wind goes above and below it, according to David G. Haase, director of North Carolina State University's Science House.

"The air below it hits the wing and gets pushed downward," says Haase. "By the law of action and reaction, the wind forced downward pushes back upward on the wing."

Also, the air underneath the wing goes a shorter distance than the air that goes over the curved wing. To keep up with the total air flow, the air on top of the wing must move faster.

According to the Bernoulli principle, when the air is slow, it creates higher pressure. When the air moves faster, the pressure becomes lower.

"High pressure on the bottom and low pressure on the top forces the wing upward," says Haase. "You need a steady wind for flying, and it helps to fly into the wind — not with the wind. You have to have wind over the wing."

For more information about the principles of flight, go online to: *www.aero.hq.nasa.gov/edu/*

— A.G.

Courtesy of the Center for Coastal Studies

NATURALIST'S *NOTEBOOK*

A Tale of a Whale

By Jason Talley

It is now winter. The cold air blows in from an open door, reminding you of the season.

You sink into your favorite chair, surrounded by the warmth of your home, and curl up with a good magazine. But, your mind wonders off to a warmer place. A place baked by the sun in the dead of winter, where crystal blue is not the color of ice hanging from the garage, but of flowing waters repeatedly washing the white sand of a pristine shoreline.

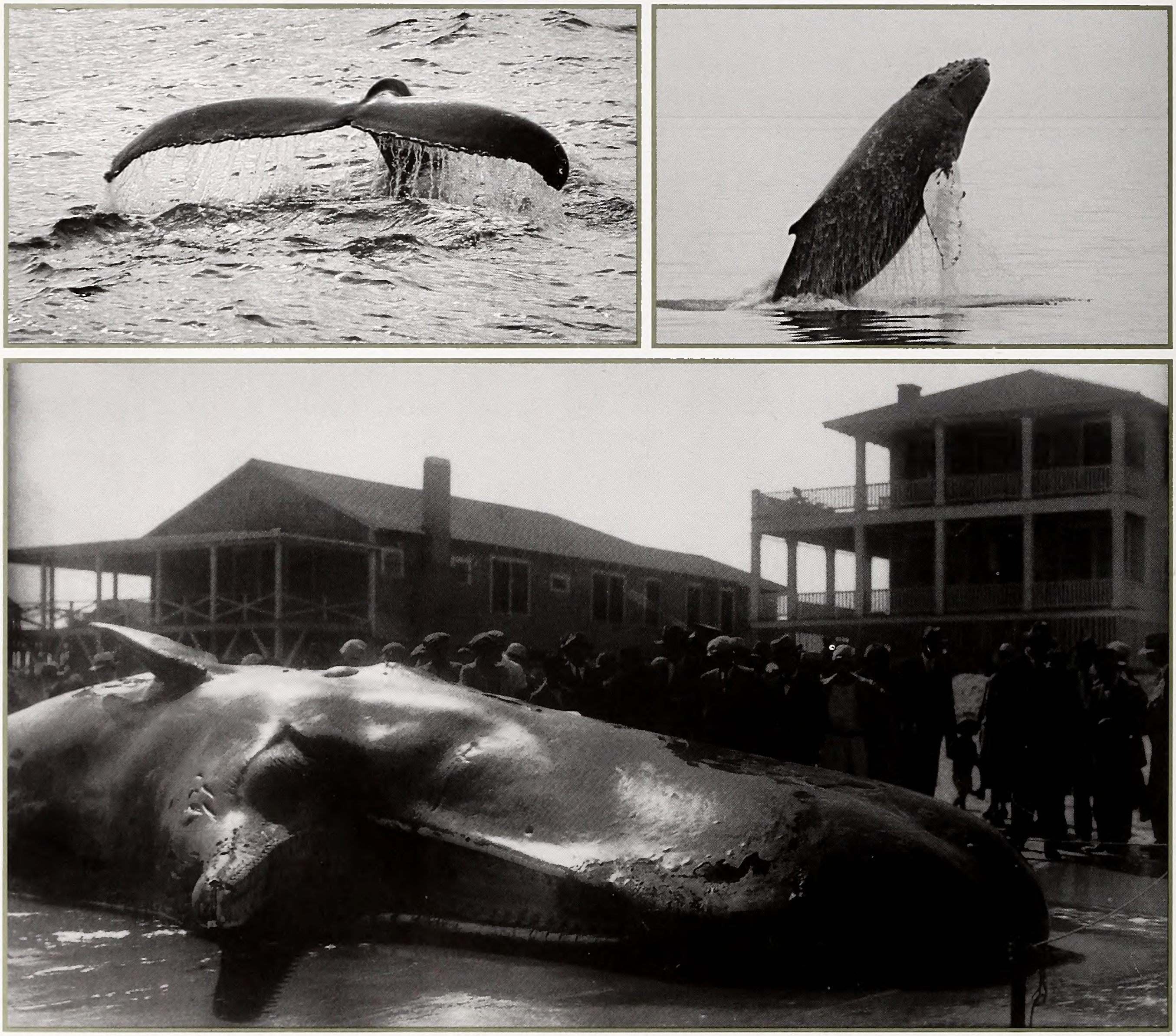
This is the Caribbean in winter, where throngs of tourists escape the cold conditions of home. This is also the place where many whales spend their winters looking for a mate or giving birth. It is here that our tale starts.

Swimming in the warm Caribbean water is a humpback whale named "Salt." Salt is the most photographed whale of all time — and at this very moment she may be giving birth to her ninth calf.

Humpback calves come into this world tail first, rolling like a barrel, and weighing 3,000 pounds. Salt is over 30, weighs over 30 tons, and measures 47 feet long. She is also the star of a whale exhibit at the North Carolina Aquarium at Fort Fisher.

Continued

LEFT: Salt's often pictured tail, off The Great South Channel near Cape Cod, summer 2002.



Scott D. Taylor

Courtesy of the Center for Coastal Studies

Courtesy of the N.C. Museum of Natural Sciences

TOP LEFT: A curious whale cavorts for the camera along the North Carolina coast. TOP RIGHT: An unknown humpback breaches near Cape Cod. BOTTOM: Stranded sperm whale Trouble on Wrightsville Beach, spring 1928. The skeleton of Trouble can be seen at the North Carolina Museum of Natural Sciences in Raleigh, along with many others, including a blue whale and humpback whale.

The aquarium, located south of Wilmington, adjacent to the Fort Fisher historical area, has a full-size mock-up of Salt and one of her calves, "Salsa." The exhibit uses Salt to tell the tale of a humpback whale and its life throughout the year.

This is an interesting tale because "people want to understand more about these mysterious animals," says Peggy Sloan, educational curator.

"People are very curious about marine mammals because they, like humans, are large brained, warm-blooded animals, but they live in a completely foreign environment," adds Sloan. Soon that environment will be the coastal waters off North Carolina, as Salt migrates to the Gulf of Maine for summer feeding.

In the spring, a newborn calf would be big enough to travel, but still dependent on Salt's milk. Every day, humpback calves drink 130 gallons of milk and gain about 200 pounds.

Salt will swim three to five miles a day as she begins the long journey to her cold water feeding grounds. She will swim continuously along the continental shelf and pass our coast in March or April with her pod. A humpback pod is usually a small family, containing only a bull (male), cow (female), and a calf.

By early summer, Salt will be in the Gulf of Maine where she will build up her layer of blubber to the optimum three to four inches. This layer of blubber keeps her warm, helps her float and provides nourishment throughout the year for traveling, breeding and rearing young.

Salt will eat up to 1.5 tons of food a day. As a baleen whale, she feeds by sifting out tons of tiny plankton — a variety of small animals and plants found near the surface in large schools. Salt also will eat krill — small shrimp-like crustaceans. She feeds using her 25-inch long baleen plates. Baleen is made of a horny fiber similar to our fingernails — varying in thickness and length depending on the species of whale.

Salt uses air bubbles to help her feed. She will dive beneath her prey and circle around blowing bubbles. This circular wall of bubbles will corral the prey. She will then swim for the surface, expand her gigantic mouth, and engulf the concentrated school of plankton or krill.

Salt completes her feeding by taking her gigantic tongue and pushing out the water in her mouth, leaving the thousands of baleen-sifted plankton or krill to be swallowed.

As autumn arrives, Salt again will make her annual 1,500-mile trip to the warm Caribbean waters off of the Turks and Caicos Islands — known as a breeding and birthing area for humpback whales. She will pass through North Carolina in November or December on her way south.

Once in the Caribbean, male humpbacks will launch themselves out of the water or "breach" in addition to "singing" to attract Salt as a mate.

Male humpbacks are known as the opera stars of the whale world. They sing a long elaborate "song" made up of groans, moans, roars, sighs, and high-pitched squeaks and chirps. Humpbacks within the same area will sing the same song. This song will change as the season changes, and each year the song varies.

Humpback whale breeding has never been documented. Scientists estimate a gestation period of 10 to 12 months.

As a new spring approaches, Salt will once again travel north to feed in the Gulf of Maine. For the record, Salt has had eight calves as of 2000. There is Crystal (1980), Halos (1983), Thalassa (1985), Brine (1987), Bittern (1989), Salsa (1991), Tabasco (1998), and Mostaza (2000).

Maybe nine now?

Wondering More About Whales?

- ***Why do whales strand themselves?*** Scientists do not know for sure. Some theories: sickness, falling asleep in shallow water, suicide, earthquakes, mistakes in whales magnetic navigation, storms, pollution, or confusion caused by sonar signals.
- ***How long do whales live?*** On average, from 15 to 60 years, depending on the species. Scientists can determine a whale's age by examining the number of layers of wax from the wax plug found in their ears.
- ***How long can a whale hold its breath?*** The sperm whale can hold its breath the longest – up to two hours – thanks to its ability to conserve oxygen by storing it and transferring it to organs more efficiently than humans.
- ***How deep do whales dive?*** Depth varies depending on the food source for a particular species. The sperm whale dives the deepest – up to 1.75 miles, where they hunt giant squid in the lightless depths.
- ***Which is the largest whale?*** The blue whale is the largest whale at 100 feet plus and more than 220 tons. The blue whale also is the largest animal on earth.
- ***How do whales communicate?*** They "talk" with clicks, squeals, moans, barks, and singing. Whale ears are small holes in their skin behind their eyes with a waxy plug inside that keeps the ear watertight and transmits sound to their inner ear. Blue whales can hear their specie's distinct low "boom" more than 1,000 miles away.
- ***What are some common whales found off of North Carolina's coast?***
  - *Fin Whale:* 56 to 79 feet, 70 tons
  - *Humpback Whale:* 36 to 52 feet, 40 tons
  - *Pilot Whale:* 25 feet, 2 tons
  - *Minke Whale:* 29 to 33 feet, 10 tons
  - *Sperm Whale:* 59 feet, 68 tons

  * Length and weight of adult whales, according to Rhode Island Sea Grant's *Guide to Marine Mammals & Turtles of the U.S. Atlantic & Gulf of Mexico*.
- ***How close do whales swim to our coast?*** Most whales stay on the edge of the continental shelf when traveling to and from breeding and feeding areas. They swim in or near the Gulf Stream (40 miles off of Cape Hatteras), which helps them travel long distances. Some whale spouts can be seen from the beach in Nags Head south to Cape Lookout.
- ***Check out the sources for this information:***
  - North Carolina Aquarium at Fort Fisher, *www.aquariums.state.nc.us*
  - North Carolina Museum of Natural Sciences, *www.naturalsciences.org*
  - Rhode Island Sea Grant's *Guide to Marine Mammals & Turtles of the U.S. Atlantic & Gulf of Mexico*. Individual copies are $25 each and can be purchased through North Carolina Sea Grant by calling 919/515-9101.
  - *Whales*, by Lesley A. DuTemple, published by Lerner Publications Company
  - *Great Creatures of the World: Whales*, by Lesley Dow, published by Facts On File
  - *Whales of the World*, by Phil Chapman, published by Voyageur Press

— J.T.

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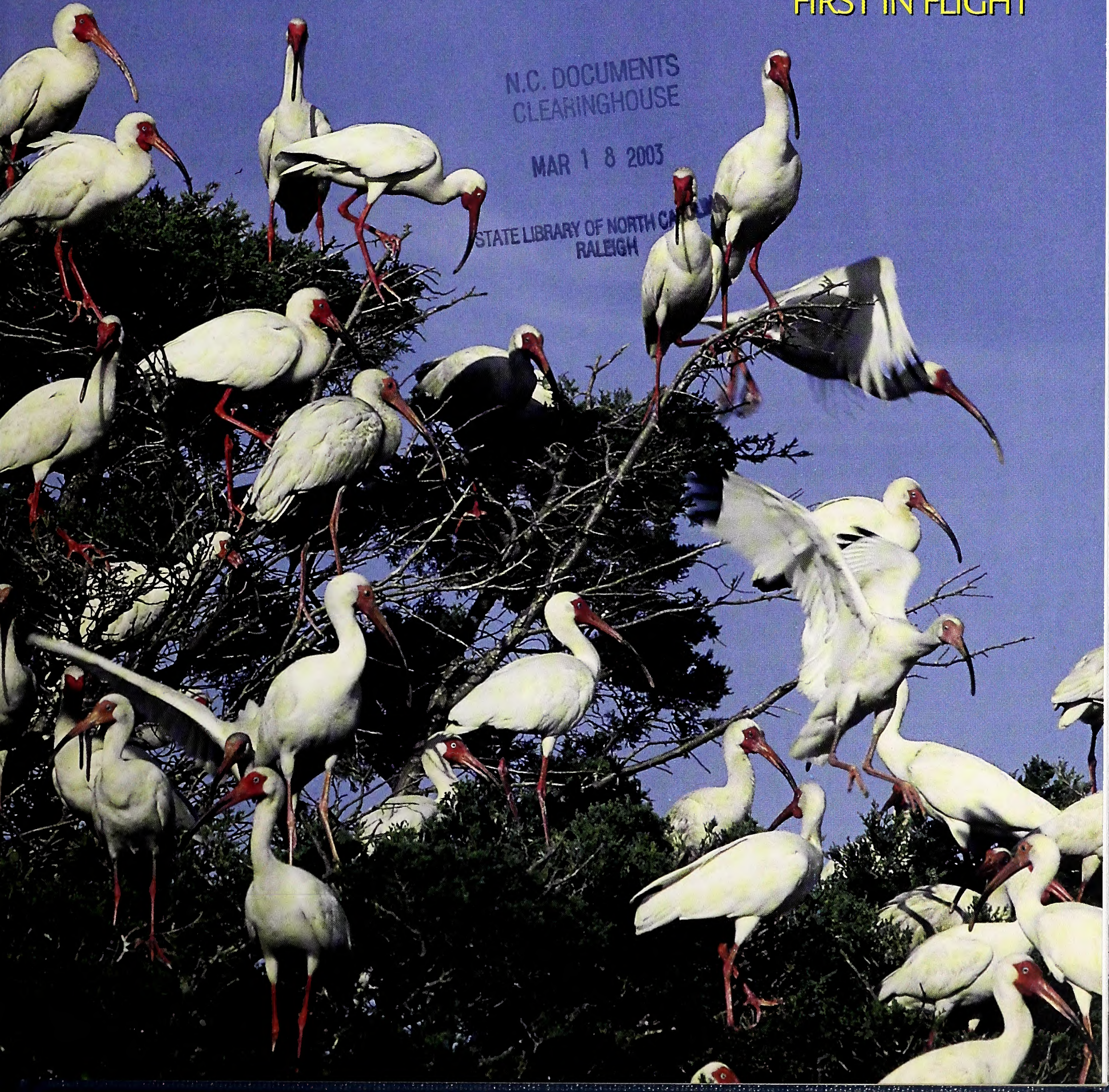

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Change Seems Constant

Allen Weiss

Lundie Spence shares a lesson.

As expected, 2003 continues to bring changes to North Carolina Sea Grant. On page 4, you can read of exciting new duties for Lundie Spence, who is now director of the Southeast Center for Ocean Science Education Excellence, based in Charleston, S.C.

She will be missed, but her regional duties will keep her in touch with North Carolina — where her trademark "marsh walks" have been as famous for her enthusiasm as for the wonderful creatures to be found.

Over the years, Lundie has received numerous honors, including being named NOAA Environmental Hero in 2000. The award recognizes individuals for their "tireless efforts to preserve and protect the nation's environment."

She continues to be a hero — one who can make connections. Even in a first meeting, Lundie listens attentively, quickly understands your plans, and suggests a person or resource to help you meet your goal. That was the case when I met her long before I joined Sea Grant. Now, of course, Lundie connects folks to me.

Here and across the state, the answer to many a question has been: "Ask Lundie." She would know whom to ask for the complete answer — be it scientist, official or local fishing patriarch.

I've already dropped her a few e-mails at the South Carolina Sea Grant Consortium. And she continues to lead Sea Grant's national marine education network.

Teachers and teachers-in-training are a special audience for Lundie. Her first Sea Grant projects included coastal curricula she developed with the late Dirk Frankenberg of the University of North Carolina at Chapel Hill. In more recent years, she coordinated COAST/Operation Pathfinder graduate courses that took teachers out of the lecture hall and into the dunes.

In 1997, she and Harriet Stubbs, SCI-LINK/Environmental Programs director at North Carolina State University, initiated the first environmental education course taught on undergraduate and graduate levels in the University of North Carolina system. Through interactive video, the course reached four UNC campuses.

Lundie has been an advocate of informal education at aquaria, estuarine reserves, parks, etc. And she passionately believes that fascination has no age boundaries — just ask participants in workshops she has led through NC State's Encore Center for Lifelong Enrichment.

And she gets folks involved. In 1987, she initiated the first Beach Sweep, which grew into Big Sweep, now an annual waterway clean-up in the state's 100 counties.

Recently, Lundie helped to develop a North Carolina coastal plain river and estuaries paddle trail network that promotes ecotourism and environmental awareness. She also provided leadership for *The Soundfront Series* estuarine guides.

Friends and colleagues have more Lundie stories than could fill this issue of *Coastwatch*. Not all are about the coast, but all make us smile. Former North Carolina Sea Grant Director B.J. Copeland recalls meeting Lundie in the 1970s, when she shared stories of caring for an abandoned goat — at her home in Chapel Hill.

One of the last items Lundie packed away in her Raleigh office was a skin of a red drum — the state's saltwater fish. It only seemed appropriate, because to many folks, Lundie is a strong symbol of our vibrant coast.

Katie Mosher, Managing Editor

IN THIS ISSUE

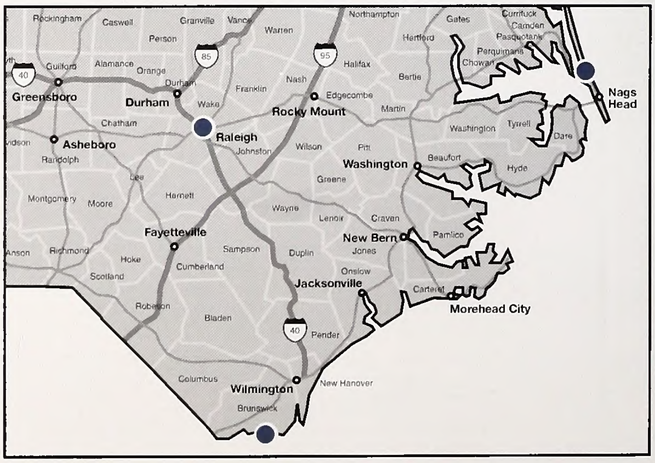
Contributing Writers:

Gianna Cohn ▫ Ann Green ▫ Cynthia Henderson
Katie Mosher ▫ T. Edward Nickens ▫ Pam Smith

Contributing Photographers:

Ken Blevins ▫ Walker Golder ▫ Michael Halminski
Ray Midgett ▫ T. Edward Nickens
Scott D. Taylor ▫ Allen Weiss ▫ Greg Wolf

North Carolina's diverse coast offers countless interesting subjects. The large dots on the locator map indicate story settings in this issue — including the Outer Banks and Brunswick County.



Coastwatch

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Coastwatch

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The North Carolina Sea Grant College Program is a federal/state program that promotes the wise use of our coastal and marine resources through research, extension and education. It joined the National Sea Grant College Network in 1970 as an institutional program. Six years later, it was designated a Sea Grant College. Today, North Carolina Sea Grant supports several research projects, a 15-member extension program and a communications staff. Ron Hodson is director. The program is funded by the U.S. Department of Commerce's National Oceanic and Atmospheric Administration and the state through the University of North Carolina.

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Front cover photo of white ibises
by Walker Golder.
Table of contents photo of a barge
by T. Edward Nickens.
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COASTAL TIDINGS

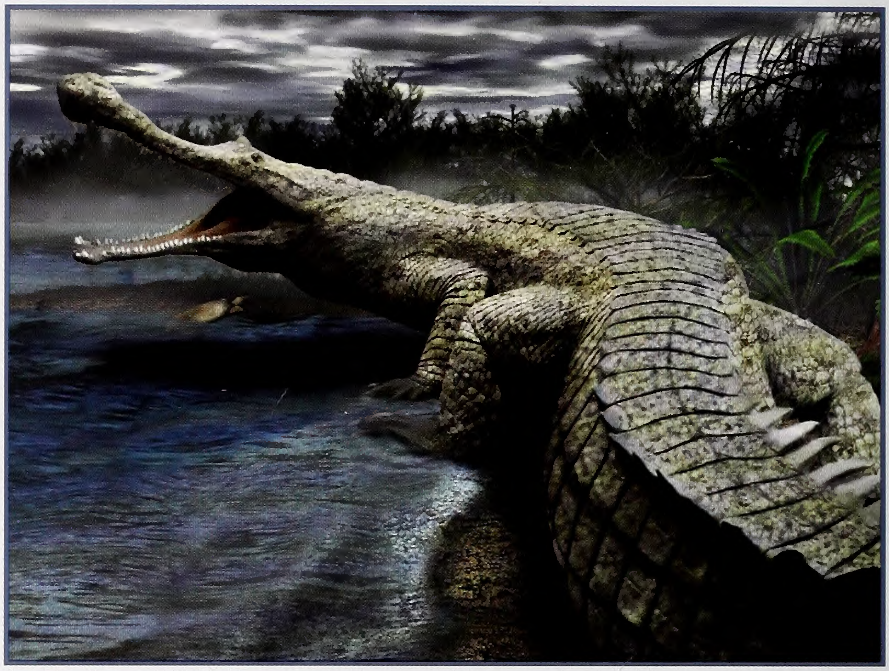


Photo courtesy of National Geographic Channel

View Ancient Crocodile Exhibit at Natural Sciences Museum

Millions of years ago, a 40-foot crocodile – as large as a school bus and ferocious enough to feed on dinosaurs – roamed the earth.

Meet the ancient beast *Sarcosuchus imperator* at the "National Geographic Presents SuperCroc" exhibit at the North Carolina Museum of Natural Sciences in downtown Raleigh. The 110 million-year-old relative of today's crocodile will be on exhibit from March 15 to May 26.

The exhibit includes a full-sized skeletal model of the prehistoric giant found in Niger, Africa, fleshed-out models of the Cretaceous crocodile's head and neck, and skulls of modern crocodiles. Video kiosks and interpretive panels depict the discovery and excavation of the fossil and offer a glimpse into the prehistoric environment where SuperCroc lived.

National Geographic Explorer-in-Residence Paul Sereno unearthed SuperCroc in 2000 from the parched sands of the Sahara Desert. Sereno's expedition found the *Sarcosuchus* skull, along with more than 50 percent of its skeleton.

Although it has achieved less notoriety, North Carolina had its own giant crocodile *Deinosuchus*, which grew to 40 feet in length and lived 30 million years after *Sarcosuchus*. The giant croc probably also preyed on carnivorous dinosaurs.

National Geographic Channel's documentary, "SuperCroc," highlights Sereno's excavation of the crocodile as well as modern crocodiles. For details, visit *www.nationalgeographic.com/supercroc/*.

To find out more about the exhibit, go online to *www.naturalsciences.org/*. – A.G.

In the Next Issue of *Coastwatch*

Ann Green visits Cedar Island to discover a welcoming community and a remote wildlife refuge. Spring planting and fall harvest have new meaning when it comes to the Edenton National Fish Hatchery, as Pam Smith learns.

Attend Wooden Boat Show

Want to sail around Beaufort in a traditional wooden boat or learn how to build a small boat or model boat?

All of these activities will be offered at the N.C. Maritime Museum's 29th Annual Wooden Boat Show. The noncommercial boat show will be held May 3 from 10 a.m. to 4 p.m. around the museum in downtown Beaufort.

The show focuses on wooden boats that are 25 feet and under. There also will be a display of ship models at the museum. In addition, students from the Junior Sailing classes will provide demonstrations.

To exhibit a boat or find out more information, call 252/728-7317 or send e-mail to *maritime@ncmail.net*. – A.G.

Students in the Cape Fear Community College marine technology program demonstrate the ROV capabilities to police, fire, rescue and Coast Guard units at a Wilmington area pool.

Copyright, Wilmington Star-News, Greg Wolf

Students Demonstrate High-Tech Mission

Students at Cape Fear Community College can go to great underwater depths without ever getting wet. Using a remotely operated vehicle (ROV), students train for offshore exploration and learn robotic basics.

The technology has multiple marine applications, college officials say.

Built-in cameras capture underwater images that are transmitted to a topside computer display screen. The ROV is equipped with lights that enable it to "see" in dark waters, and with an arm that can pluck objects from the bottom.

These features enable work teams to overcome daunting conditions — turbulent and turbid waters — to achieve their mission. The ROV can go where divers often can't, such as under ships to inspect for damage or into dangerously polluted waters.

The vehicle can dive down to 500 feet and move at about 5 miles per hour. Its computer technology allows the operator to prepare the ROV for specific conditions — salt or fresh water, water temperature and depth. – P.S.

Ray Midgett

This stranded seal was found at the Outer Banks in January.

Seals Found on Outer Banks

In January, five harbour seals were found along the Outer Banks. They appeared individually all along the coastline – Kitty Hawk, Rodanthe, Cape Hatteras, Nags Head and Corolla – from Jan. 4 to 25.

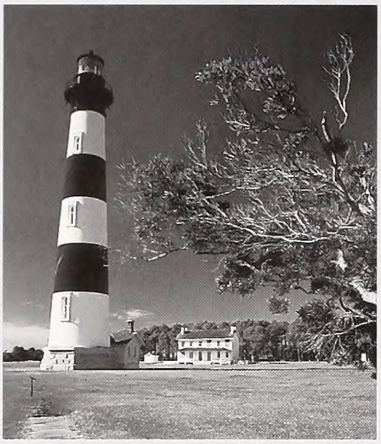
The five harbour seals were not a surprise to those working on the North Carolina coast. Three were found in 2002. The species prefers temperate and subarctic coastal waters.

The most recent visitors were smaller, subadult seals, four males and one female, that probably just lost their way.

The five wayward animals were transported to rehabilitation centers on the East Coast. They were all found to have upper respiratory problems and some minor cuts. The three surviving seals will be released into the wild from Maine, New York and New Jersey.

Due to the cold spell in January, these strandings are not unusual. However, federal officials are monitoring the East Coast for possible trends. The population of habour seals is thought to range from 400,000 to 500,000 worldwide.

If you should find a marine mammal, alive or dead, do not approach it. Call Rachel Lo Piccolo, marine mammal stranding coordinator, in Beaufort at 252/728-8762. – G.C.



Scott D. Taylor

Bodie Light to Get Facelift

The National Park Service is readying the Bodie Island Lighthouse for major restoration. The 1872 structure is due for a $1.7 million, top-to-bottom overhaul, according to NPS officials. Work is not expected to begin until 2006.

Meanwhile, research will ensure the makeover will be historically accurate – from paint colors to roofing materials.

Some restoration on the lighthouse was recently completed with funds from "Save America's Treasures," a federal/state matching program.

The first Bodie Island Lighthouse was built in 1848 on Pea Island for $12,000. A decade later, it was deemed unserviceable. Its replacement – also on Pea Island – was constructed for $25,000 and included an improved lens. The second lighthouse was destroyed during the Civil War.

The present Bodie Island Lighthouse was built north of the Oregon Inlet on Hatteras Island, for a total cost of $140,000.

The proposed refurbishing project will include shoring up its iron staircase, cleaning, painting or replacing any deteriorating metal parts, and repairing masonry, trusses, windows, woodwork and flooring.

Once Congress appropriates the money, it is estimated that it will take about two years to complete the work.

– P.S.

Plan Beach Trips with DCM Web Site

In the spring, a North Carolinian's fancy turns to thoughts of the beach. Now, locating public beach access sites along the coast is easier, thanks to the N.C. Division of Coastal Management (DCM). Using a geographic information system (GIS) database, DCM has developed an online guide to public access points.

Here's how it works: Go to *www.nccoastalmanagement.net/access/sites.htm*. The access site page displays a map of the 20 coastal counties. Select a county or town, and zoom to that location.

The public access sites are grouped into four types: regional, neighborhood, local and urban waterfront. Facilities vary greatly according to type and location.

The Web site provides details for each location, including information about parking, picnic areas, restrooms or shower facilities — or lack of them.

Visitors can help keep the site location information updated by reporting errors in Web site information provided. E-mail comments, including location identification, to *mike.lopazanski@ncmail.net*.

– P.S.

Spence New Southeast COSEE Director

NC State Communication Services

In her more than 20 years as North Carolina Sea Grant marine education specialist, Lundie Spence was a leader in the environmental education movement in North Carolina.

In February, Spence became the director of a new Southeast Center for Ocean Science Education Excellence (COSEE) in Charleston, S.C.

"Teachers, students and many others have benefited from Lundie's environmental education classes, teacher workshops and special projects," says Ronald G. Hodson, North Carolina Sea Grant director. "Lundie's energy, creativity and leadership skills will be greatly missed within our staff. However, Lundie will continue to use her vision and commitment to ocean science education in her new regional COSEE position."

Funded by the National Science Foundation, COSEE will develop partnerships to integrate ocean science research from North Carolina, Georgia and South Carolina into high quality education programs in kindergarten through 12th grade.

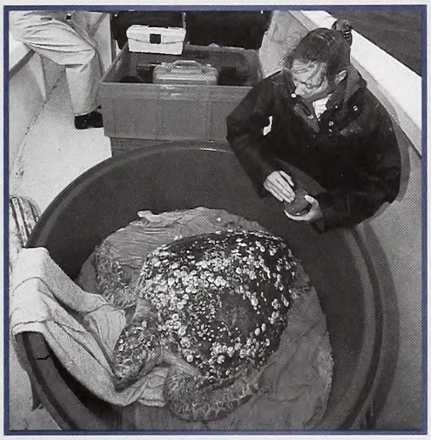
One of the program's goals is to increase the involvement of under-represented groups in marine sciences. In addition to the southeast office at the South Carolina Sea Grant Consortium, there are COSEE centers in California, Mississippi, Florida, New Jersey and Massachusetts, and a coordinating office in Washington, D.C.

"Lundie is an energetic visionary," says North Carolina Sea Grant legal and policy specialist Walter Clark, who co-taught NC State courses with Spence for more than 17 years.

"She has the talent to identify needs and develop strategies, as well as the contagious enthusiasm to bring people together to collaboratively seek solutions. Although I will miss Lundie personally and professionally, I am sure she will continue to inspire anyone interested in the coast or ocean."

– A.G.

Turtle-Watch: Travel, Health Updates



Scott D. Taylor

Of 21 turtles tagged in the Pamlico last fall, some have traveled far, according to Catherine McClellan, the Duke Marine Lab research assistant who carried out the study. The N.C. Fishery Resource Grant Program funded the project, which was featured in the last issue of *Coastwatch*.

One loggerhead and a Kemp's ridley headed south to Florida, fortuitously escaping an unusually snowy winter here.

Three others have gone very far out in the North Atlantic. "One is nearly half-way to the Azores," McClellan says.

A lot of sea turtles are "just hanging out" off North Carolina's coast, McClellan adds.

One surprising finding, she says, is that all the Pamlico's inlets were turtle exit points.

"Another interesting point was that the turtles remained in the sound longer than expected based on water temperatures," she writes in an e-mail communication. "There were a lot of cold-stunned turtles this year as a result."

The study could lead to ways to predict sea turtle movements to keep them out of gill nets — protecting both the legally protected reptiles and the fisheries that are subject to closures when turtle strandings or incidental takes exceed established limits.

Meanwhile, Catherine — the loggerhead highlighted in the *Coastwatch* article — continues to improve, according to the Web site for the sea turtle hospital on Topsail Island.

Read future *Coastwatch* issues to follow the turtle study. To check the progress of Catherine, the sea turtle, go to *www.seaturtlehospital.org*.

— C.H.

Sullivan Leads New Hybrid Striped Bass Program

The Striped Bass Growers Association (SBGA) recently upped the ante for the industry's future productivity — and profitability. The SBGA endorsed the formation of a National Breeding Program for the Hybrid Striped Bass (HSB) industry.

North Carolina Sea Grant and North Carolina State University have been major players in developing protocols for large-scale HSB aquaculture pond production since the industry's earliest days.

The new breeding program is meant to bolster the scientific/technical capabilities of the HSB industry and collaborators from academia and government agencies, says Craig Sullivan. Sullivan is a renowned NC State hybrid striped bass researcher, whose ongoing studies have been supported by North Carolina Sea Grant.

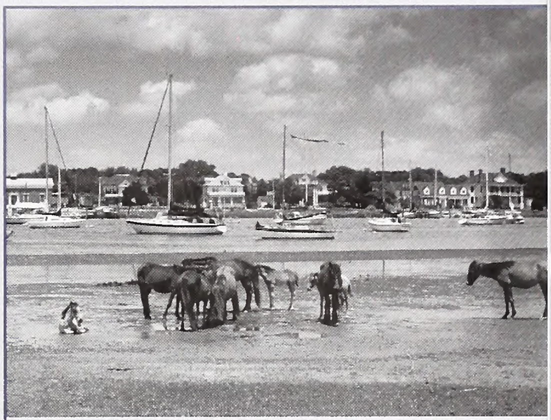
Sullivan will coordinate the national program with Don Freeman of the U.S. Department of Agriculture.

While the HSB industry has grown since its inception in 1984, increases have slowed due to global competition.

Larger issues include the losses of HSB production to disease and the dependence on obtaining fingerlings from wild broodstock. These issues can be addressed through selective breeding and genome mapping, Sullivan says.

The program will be open to all stakeholders and researchers, who will seek to identify the most effective means to deliver improved cultivars to the HSB industry. Participants will meet each fall to discuss activities. The first workshop will be held in 2003.

— P.S.



Scott D. Taylor

Shackleford Banks' Horses on the Move

In an effort to control numbers of the Shackleford Banks wild horse population, the National Park Service and the Foundation for Shackleford Horses conducted a roundup in January.

Federal legislation in 1998 mandated that at least 110 horses be maintained on the island — one of the few places along the East Coast where wild horses roam.

Five horses joined the herd on Cedar Island, while another 16 were placed for adoption by the public. The remaining 120 horses will stay on Shackleford Banks — a barrier island that is part of the Cape Lookout National Seashore.

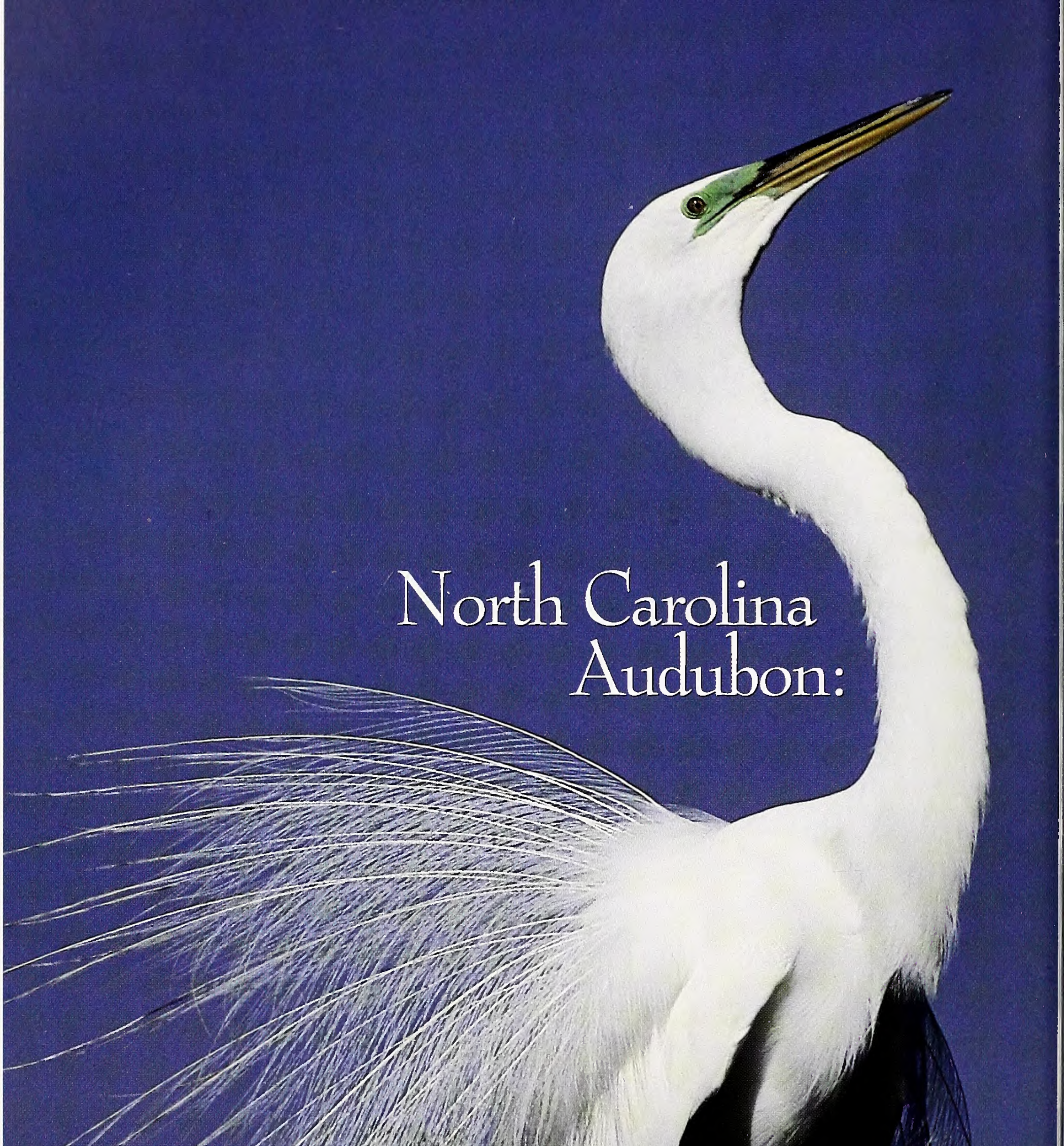
During roundups, which take place every one to two years, blood samples for genetics research are collected and pregnancy testing is conducted. Contraceptive injections are administered to help control the herd's size. Populations must be contained because of limited forage and fresh water sources on the tiny island.

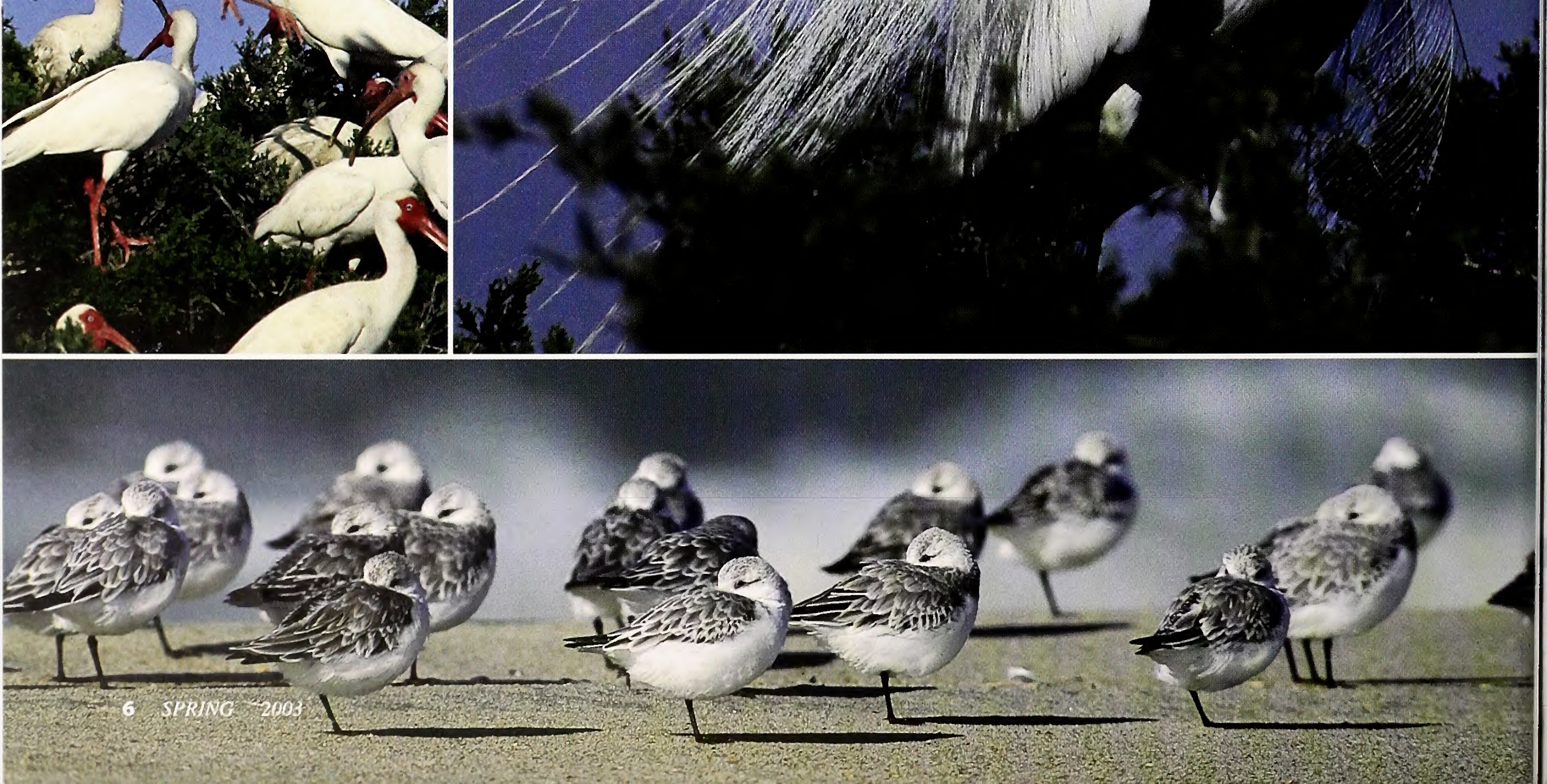
The foundation established the adoption program. Eligible foals — those approaching their first birthday — are taken to area farms to help them make the transition from wild herd to a more domestic environment.

For more information, contact Sue Stuska at Cape Lookout National Seashore, 252/728-2250, ext. 3017.

— P.S.

North Carolina Audubon:





AUDUBON

A Century of Conservation

By Pam Smith

Photographs by Walker Golder

LEFT: White Ibises congregate in thicket tops on Battery Island , an important habitat for ibis, herons and egrets.

RIGHT: The Great Egret shows off its snowy plumage at Battery Island near Wilmington.

BOTTOM: Shorebirds rest after eating their fill of critters available at low tide on shoals of undisturbed islands along the North Carolina coast.

When T. Gilbert Pearson founded the North Carolina Audubon Society 100 years ago, he couldn't have known that his lifework would help shape bird conservation policies at state, national and international levels well into the next century.

"He was passionate about the need to protect North Carolina's birds and their habitat," says Chris Canfield, executive director.

Pearson's zeal — and his science — convinced audiences that it was time to put an end to the slaughter of tens of thousands of coastal birds each year by market hunters. Colorful plumes, skins and wings were used to adorn women's hats and other accessories. At the dawn of the 20th century, Great Egret plumage reportedly was worth more per ounce than gold.

Pearson, a nationally respected ornithologist, helped launch the National Audubon Society in 1900. The organization sought to push for legislation to protect birds, to educate the public, and to promote conservation through research, sanctuaries, and wildlife warden programs.

Asked to spearhead a state chapter, Pearson called the first meeting to order in 1902 at the State Normal College, now the University of North Carolina at Greensboro, where he was teaching and writing about bird conservation.

"After just a year, a bird protection bill he drafted was introduced in the North Carolina House of Representatives," Canfield explains.

A lot was at stake. Pearson's scientific field surveys showed significant population declines of many species that had been recorded as early as 1585. By 1903, he reported, only 1,700 colonial water bird eggs were laid on the entire North Carolina coast.

"Not only did lawmakers pass the Audubon Act, but they also gave the Audubon Society authority to enforce all game laws, not just those related to birds.

"Thus came about the South's first statewide game commission, a forerunner of the state's Wildlife Resources Commission," Canfield says.

Meanwhile, Pearson assumed duties in the national Audubon organization, and was influential in the passage of the landmark federal Migratory Bird Treaty Act of 1918.

He left his mark on international law as well, founding the International Committee for Bird Protection — now the International Council for Bird Preservation in 100 countries.

Science Matters

All the while, Pearson continued his coastal North Carolina bird studies. He teamed with naturalist brothers Clement Brimley and H.H. Brimley of the North Carolina Museum of Natural History, to research and write *The Birds of North Carolina.* Completed in 1913, their 380-page report was part of the North Carolina Geological and Economic Survey commissioned by the office of the state geologist.

Even after decades of observing coastal birds, Pearson's descriptions reveal his awe at coming upon a colony of some 3,000 nesting Royal Terns on Royal Shoal Island — one of the two island sanctuaries near the Outer Banks that Audubon purchased in 1907. He writes:

> *... On approaching one of these groups, the birds arose en masse and hovered in the air, with heads to the wind.*
>
> *Taking my stand to windward of the field of eggs, I at once had the satisfaction of seeing the birds settling at the other end. Soon others began alighting nearer. I remained stationary and watched the splendid sight. ...*

The timing for the rise of the Audubon movement was right. "There was a revival of interest in nature and natural science. Teddy Roosevelt established the U.S. Fish & Wildlife Service, and national park sites were being designated," says Canfield.

In the decades that followed Pearson's death in 1946, Audubon membership — and

Continued

Taking my stand to windward of the field of eggs, I at once
Soon others began alighting nearer. I remained station

This White Ibis tends to a precious egg in its thicket nest on a protected island.

A colony of Royal Terns stake claim to a sandy stretch of Ferry Slip Island.

influence — ebbed and flowed. The erosive energy of sea and wind wore down Legged Lump and Royal Shoal islands. The islands disappeared, but the vision of an Audubon sanctuary program lived on.

Different Pressures, Solutions

Earth Day 1970 rekindled environmental awareness across the country.

Market hunters were long gone from the scene by the mid-1970s, but coastal development was beginning to crowd out nesting habitat. Pollution, the use of pesticides and other human disturbances also threatened resident and migrating bird populations.

Scientists, however, never lost sight of the need to protect coastal resources that support marine and wildlife.

"Human disturbance is the number one concern," says James Parnell, a retired University of North Carolina at Wilmington zoology professor. For more than a decade, beginning in the 1970s, Sea Grant funded much of Parnell's benchmark research. "When human disturbances get too much, they leave."

It was Parnell who first realized the importance of man-made dredge spoil islands that dot the Intracoastal Waterway and the state's estuaries. These islands provide nesting habitats for large colonies of waterbirds that used to nest along once undeveloped beachfront.

His 1982 work with Audubon focused on Battery Island and Striking Island, near Wilmington. Audubon leased the complex from the state to study bird sanctuary management methods. Parnell and graduate students looked at population dynamics, the birds' reproductive biology and nest site characteristics. They also looked at ways to manipulate the habitat to produce a stable, long-term environment for the birds — from ground-nesting terns to thicket-nesting herons.

Battery Island/Striking Island pilot projects became part of Audubon's renewed Coastal Island Sanctuary System. In 1989, Walker Golder was appointed manager of the system that now includes 20 islands from Virginia to South Carolina. Four are managed jointly with the N.C. Wildlife Resources Commission.

Parnell and his graduate students conducted a census of nesting sites from Currituck Sound to the Lockwood Folly Inlet. Their 1990 report, "Management of North Carolina's Colonial Waterbirds" (UNC-SG-90-03), provides site-by-site management recommendations. With Golder, Parnell produced the "1993 Atlas of Colonial Water birds of North Carolina Estuaries" (UNC-SG-95-02).

Both of these publications provide baseline data essential for coastal managers today, Parnell says.

Many of the modern-day Audubon scientists can trace their lineage back to Pearson. Parnell earned his bachelor's and doctoral degrees under North Carolina State

d the satisfaction of seeing the birds settling at the other end.
y and watched the splendid sight. . . . T. Gilbert Pearson

A Least Tern protects her chick on a sandy nest on a dredge spoil island.

Big Sweep volunteers fill bags with debris washed ashore on Battery Island.

University's Thomas Quay, a noted ornithologist whose work was influenced by Pearson. Donald McCrimmon, who also studied under Quay, worked for the National Audubon Society. He collaborated on the Battery Island project and proposed renewing Audubon sanctuary system, based on Parnell's management methods. Golder, now Audubon deputy director, was Parnell's student and worked with Parnell and McCrimmon to design the sanctuary system.

Parnell, though, worries that as science goes "high-tech," universities may be moving away from natural history. "It's also true that many colleges are cooling down on field-oriented studies. Naturalists are few and far between," he says.

Full Agenda

Yet, Golder finds interest is still high among graduate students and interns who are eager for field experience.

For example, Golder is working with Donald Auer, a graduate student at Duke University's Nicholas School of the Environment, to map Important Bird Areas (IBAs) using Geographic Information System technology.

"GIS is one of the most powerful tools available for creating precise maps of our IBAs," Golder says.

The emphasis is on identifying areas with habitat types known to support significant populations of birds, especially endangered, threatened, of special concern, Watchlist, or high-priority species.

"When completed, we will have a clear picture of important habitats and conservation needs for North Carolina's birds from the mountains to the coast," he adds.

Other critical jobs — such as spring and fall bird counts — don't require technology any more advanced that an alarm clock to get you up to catch low tide; a good spotting scope or binoculars; a clip board with data sheets; and a skiff to drift through shallow estuarine waters. Bottled water and sunscreen also are recommended.

Like Pearson, Golder still gets excited by unexpected sightings.

On a fall shorebird count, he spots 13 Piping Plovers at Rich Inlet near Wilmington. "Thirteen Piping Plovers in one place at one time," he exclaims. "That's a great bird to start the day with." When another nine of the endangered birds show up at Topsail Inlet, he is downright ecstatic.

With no visible color bands, it's impossible to know their "home" nesting place. They may be from as far away as Canada, or from nearby Hutaff Island where a pair were seen last year. Scientists are keeping a close watch on the Piping Plover. Sightings are reported to state Fish & Wildlife officials for the national count. Last year, there were only 22 pairs of nesting Piping Plover sighted in North Carolina.

Because Piping Plovers lay their eggs on sandy beaches, they are vulnerable to all sorts of disturbances from beachgoers and family

Continued

What's this have to do with birds? We want t
It's not enough to erect a feeder if there is no h

A Greater Yellowlegs is a welcome addition to avid birders' lifelists.

Rich Inlet shoals provide a stopping-off place for thousands of migratory birds.

pets to stormy high tides.

At low tide, the shoals off the small estuarine islands provide an abundant food source for resident and migrating birds. "These intertidal shoals are essential to shore birds who gather to feed and rest for the next big leg of their journey," Golder says.

Shorebirds must store a gram of fat a day to complete their long migration.

The nearby islands and surrounding marsh provide habitat for both resident and migrating birds.

Golder and a team of wardens stationed at the coastal sanctuaries conduct year-round field work. He also is working with graduate students to survey the Lea-Hutaff Island complex, south of Figure Eight Island. "We are establishing baseline data that will enable us to monitor nesting success of birds there," he explains.

Volunteers and chapter members provide "extra hands" for many projects. A group of volunteers from General Electric-Wilmington are helping restore habitat on a protected island near the Cape Fear River. The idea is to provide a succession of habitats — from flat sandy areas to thickets and tall trees.

Members of the Cape Fear Garden Club are long-time supporters of Audubon's Battery Island. Over the past three years, they have purchased and planted an acre with yaupon and red cedar trees. The trees provide ibis, heron and egret habitat.

Community volunteers also pitch in during annual Big Sweep to help clean up debris that comes ashore at island sanctuaries. Trash, such as discarded fishing line, can mean certain death for birds, Golder notes.

Science Still Matters

"It's important to use good science to show why it's critical to preserve habitat — from intertidal shoals to mountain streams," says Canfield, who assumed the state leadership role in 2000.

In 1997, Camilla Herlevich, executive director of the Coastal Land Trust, was hired as the director of the newly reorganized Audubon North Carolina. She and the state board of directors set a full agenda and conducted a national search for a permanent executive director. Priorities include research, education, public policy work, and chapter support.

"I think that Audubon has several traits that distinguish it from other environmental and conservation organizations. It is rigorously science based. Its policy expertise is based on sound science and hands-on experience as the owner of a stellar system of sanctuaries for birds and other wildlife," Herlevich says.

And, it is focused on environmental education. "The education focus points to Audubon's future strength," she says.

For Audubon, there is no one-size-fits-all approach to education. Part of its strategic plan is to establish a network of community-based Audubon Centers, says Andy Wood, education director. The centers would provide hands-on

how that birds are part of a bigger environment.
itat for the bird to build a nest. . . . Andy Wood

Black Skimmers in flight provide a showy sight along the shore of one of Audubon's coastal sanctuaries.

experience in nature for thousands of children and families.

"The focus is to get immersed in nature — to empower and encourage people to participate in nature," Wood says. "The measure of success? Seeing citizen scientists engaged in monitoring the health of their neighborhoods from bird counting to monitoring waterways. In other words, getting involved with 'real-time' science."

Watching Wood in action at Burgaw Middle School in Pender County, it's easy to see that he enjoys the face-to-face teaching mode. Wood initiated Science Explorer, an afterschool enrichment program, for the 2002-2003 school year.

"The goal is to increase their awareness of wildlife around them and to demonstrate the importance of the environment in their daily lives," Wood says.

"Students are really into it," he adds. "This is not your usual organized sport activity. We just poke around in the school yard. Turn over a log, see what scrambles out. It's all about making the connection to the outdoors, looking closely and getting excited about what you discover."

On this particular fall day, the students make a significant find: the rosey wolf snail, an invasive, non-native species that eats other snails.

The students log every critter they find in the school yard each session and add to the list they are compiling. They will compare the entries as the seasons change, and study the life history and inter-relationship of their discoveries, Wood explains.

"What's this have to do with birds? We want to show that birds are part of a bigger environment. It's not enough to erect a feeder if there is no habitat for the bird to build a nest. We want to show habitat as a whole, and that birds are a special part of it."

Audubon's environmental goal is to create a "culture of conservation" for all generations. "It's about connecting people to the natural world and inspiring them to protect it," says Wood.

Getting Involved

To learn more about educational programs or local and state activities, visit Audubon North Carolina on the Web at *www.ncaudubon.org*. Or, check programs offered by local or state parks, national refuge sites, or national seashore sites.

Bird watchers can join national counting events throughout the year:

- International Migratory Bird Day, May 10, sponsored by the U.S. Fish & Wildlife Service. Individuals and groups can participate. For information, call 703/358-2318 or go to *http://birds.fws.gov/imbd/*.
- Project Feederwatch, from November through March. Participants record weekly counts of birds visiting their feeders. Participants report results to Cornell University Laboratory of Ornithology. Go to *www.ncaudubon.org*.
- The Christmas Bird Count, an Audubon tradition since 1900. Go to *www.ncaudubon.org*.
- The Great Backyard Bird Count, Feb. 15 to 18. State checklists are provided, and participants enter their counts online. The annual event is sponsored by the National Audubon Society and Cornell Laboratory of Ornithology. Go to *www.ncaudubon.org*.
- Wings Over Water, autumn migration, Outer Banks. Weeklong activities include birding events. Go to *www.northeast-nc.com/wings*.

OCEAN RES

TEST SKILLS IN TREACHEROUS WATERS OF THE ATLANTIC

By Ann Green • Photographs by Michael Halminski

It's a brisk spring day at Kitty Hawk beach. Several swimmers in black wetsuits plunge into the 67-degree water of the Atlantic Ocean.

A crowd gathers as an orange and white U.S. Coast Guard helicopter whirls over the beach and flies out 700 yards beyond the shore.

The helicopter hovers near a boat and some swimmers. Then a Coast Guard flight mechanic lowers a stainless steel rescue basket into the choppy waters.

With the surf surging four to five feet, a swimmer tows a man toward the helicopter and lifts him into the basket.

Within a few seconds, the basket with the man is lifted up to the helicopter door.

Fortunately, the man is not hurt. He is just participating in a practice mission for Kitty Hawk Ocean Rescue that is the first to include the Coast Guard.

"The training is as good as you can get," says Cole Yeatts, ocean rescue director of the Kitty Hawk Fire Department. "It teaches the lifeguards about hazards of the water when conditions are bad. It also reinforces everything they have learned."

In the middle of the ocean, the helicopter's rotorhead generates winds from 70 to 100 knots and so much spray that the swimmers have trouble breathing. They use their hands to create air pockets.

During the exercise, lifeguards practice being victims and rescuers. Each one jumps off the boat and swims toward the helicopter and then assists with a rescue.

"I was pleasantly surprised that all the Kitty Hawk lifeguards were in such good swimming condition," says Coast Guard Petty Officer 1st Class Gerald Hoover.

The joint training also benefits the Coast Guard crew.

Michael Halminski

Cole Yeatts looks out in the Atlantic as Kitty Hawk lifeguards jump off a Coast Guard boat into the choppy sea.

"It helps us to swim in the surf," says Hoover. "We like to be well-rounded."

The Coast Guard exercise is the culmination of 96 hours of training for the Kitty Hawk lifeguards, which includes biology lessons on sea creatures as well as buoy drills in the breaking surf.

"The Coast Guard exercise was the highlight of our training," says lifeguard Rebecca Harris. "It was so cool. I had never been on a helicopter before. It was incredible being lifted up."

Across the Outer Banks, lifeguards have to be prepared for a variety of emergencies — from swimmers in distress near the shore to boaters in trouble up to 200 yards offshore.

"Lifeguards have to deal with whatever happens," says Yeatts. "The ocean can be as sweet as a loving mother or as vicious as a rabid dog. A lot of people fail to realize the real dangers."

Because of the treacherous waters along the Outer Banks, Kitty Hawk ocean rescuers have to be in top physical shape, including swimming 500 meters in 10 minutes, and have emergency training.

"I look for more than being a first responder," says Yeatts. "Lifeguards need a background in emergency services and training in how to deal with a crisis. I look for people in their 20s. The mean age for our lifeguards is 30. Our lifeguards have an average of seven years of ocean rescue experience."

RIP CURRENTS

Ocean rescuers also have to learn how to spot rip currents, which occur along the ocean shoreline as well as the Great Lakes, explains North Carolina Sea Grant coastal erosion specialist Spencer Rogers. Rip currents are created when water rushes out to the sea in a narrow path. Often they form in a break in a nearshore sandbar, or near a groin, jetty or pier.

Rip currents rank as the number one cause of rescues, according to the U.S. Lifesaving Association. In 2000, lifeguards across the U.S. made more than 22,668 rescues because of rip currents. In North Carolina, there were an estimated seven rip current fatalities in 2001, according to the National Weather Service. That total may not include rescues by other beachgoers, police and rescue squads.

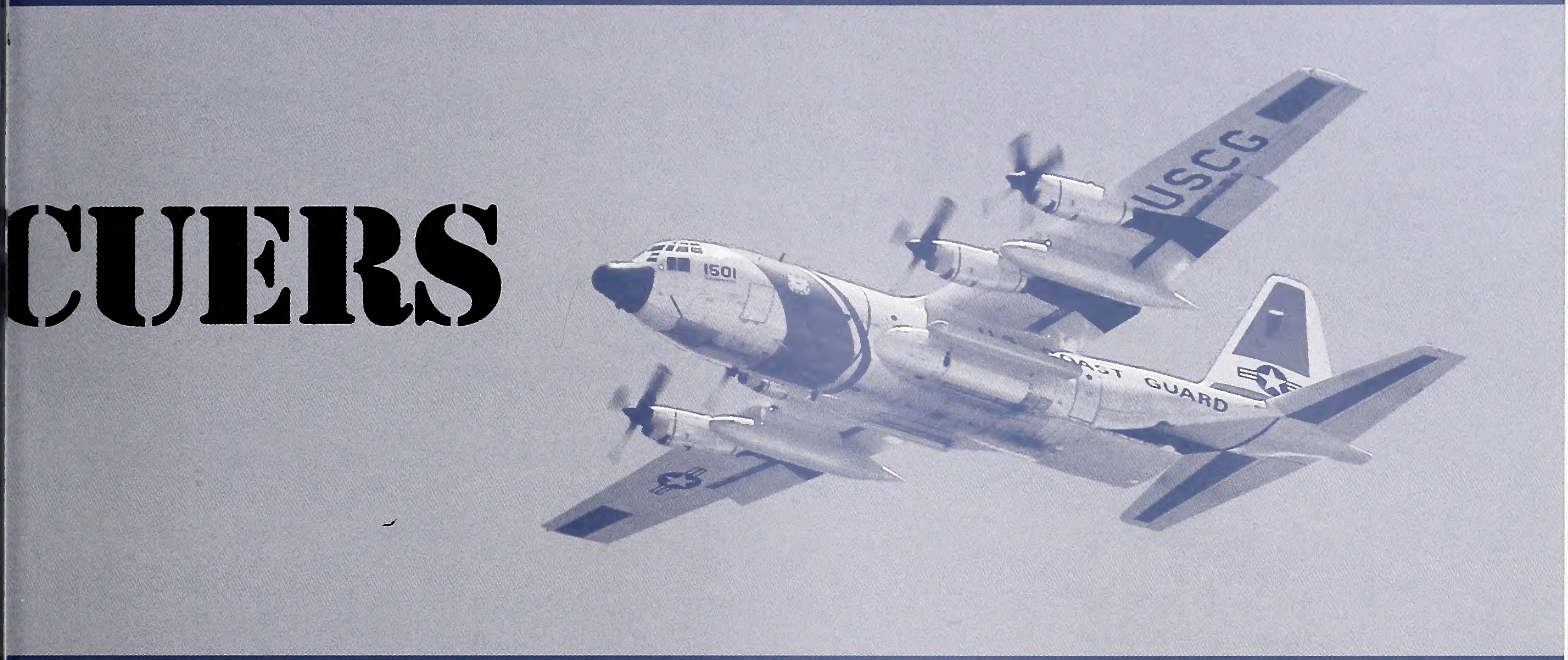
To ensure safety at North Carolina's beaches, North Carolina Sea Grant and the National Weather Service joined with local communities last year to expand a rip current public awareness campaign. Through the partnership, more than 500 permanent rip current awareness signs were placed at beach parking lots, access sites, crossovers and lifeguard stands along the state's ocean beaches.

Swimming parallel to shore — rather than

Continued

Background photo by Scott D. Taylor

CUERS



fighting the rip current — is a focus of the educational efforts. Most trouble spots are less than 30 feet wide.

In 2001, North Carolina offices of the National Weather Service (NWS) began offering daily forecasts for rip current potential, a service patterned after a forecast scale developed in Florida through the work of NWS, local lifeguards and university researchers.

"If there is a rip current, our lifeguards need to know where it is," says Yeatts. "When the surf is the biggest on red flag days, our people are out there training."

Along the Kitty Hawk beach, a sandbar stretches the entire length of the beach and has fixed rip currents, according to Yeatts.

"We give nonstop education about rip currents," he says of lifeguard chats with beachgoers. "We do it every day and all day long. Education is the best method of rescues."

Yeatts says the biggest rip that he has seen was in 1996 when the current spread 150 feet wide.

The second highest cause of ocean rescue accidents is rough surf, according to the lifesaving association.

Yeatts says that he sees a lot of spinal injuries from playing in shallow water or inshore breaks. "You shouldn't body surf or surf in inshore breaks," he adds.

Drownings also can occur on calm days when a "west wind is blowing, and the ocean looks like a lake," says Yeatts.

"Everybody gets a false sense of security, and they fail to realize that a west wind can blow them out to sea," he says. "I have had to rescue people who were on rafts and could not get back in."

MEDICAL EMERGENCY RESPONSES

Ocean rescue staffs also respond to a lot of medical emergencies — from cardiac arrest to heat exhaustion.

Jet skis and buoys have become standard rescue equipment along the Outer Banks. Ocean rescue services also use trucks equipped with gas supplies, backboards, marking floats, a global position system and other devices.

"Kitty Hawk Ocean Rescue just developed a rescue board for standup jet skis," says Yeatts. "The jet ski is a great piece of rescue equipment."

For rescues farther out, or to search for bodies, the Coast Guard assists by bringing a boat, airplane or helicopter.

"The helicopter is used for 600 miles out," says Hoover. "We have flown all the way from Elizabeth City to Bermuda."

In 2002, the Coast Guard made between 400 and 500 rescue calls along the Outer Banks, according to Hoover.

Aviation survival training is provided at the Coast Guard station in Elizabeth City.

"The wait to get in rescue training at Elizabeth City is about 24 months," says Hoover. "The average individual is in the Coast Guard three to four years before getting in rescue training."

To start rescue training, Coast Guard technicians are sent to an air station where they learn everything from driving a fuel truck to how to approach an aircraft.

After that, they spend 17 weeks at the Aviation Survival Technical Training Center in Elizabeth City.

In the first phase of the training, the technicians learn basic lifesaving techniques, including underwater training.

"We teach students to save themselves," says Senior Chief Brad Torrens. "It is like underwater judo. If you were in the water and someone comes from behind and grabs your head, you have to use pressure points, leverage with arms and brute force to take control of the survivor."

The technicians also undergo a lot of physical fitness training, including towing each other while outfitted in a mask, fin, snorkel and rescue harness. In addition, they run and do push-ups and chin-ups.

In the second phase, they actually practice rescue attempts, including placing victims in rescue baskets.

For the last phase, the Coast Guard rescuers learn how to disentangle a victim from a parachute and about other multi-rescue scenarios.

A Coast Guard helicopter drops a stainless steel basket into the water and lifts a man to safety.

"In one drill, they have to rescue six people one after the other in 30 minutes," says Torrens. "All the drills are derived from actual search and rescue efforts by the Coast Guard Helicopter Rescue Swimmers. The school is one of the most physically challenging schools in the military."

EARLY LIFESAVING SERVICES

Lifesaving efforts began in the U.S. in the early 1700s when dories were launched from shore to save victims of shipwrecks.

During the late 1800s, the U.S. Lifesaving Service built seven stations along the Outer Banks. All told, 29 stations were built along the North Carolina coast, including the Pea Island station on the northern Outer Banks — which had the only all African-American crew.

Like other emergency responders, the lifesavers worked long hours, with daily drills and foot patrols throughout the night. However, when someone cried "ship ashore," the boredom ended. The rescuers used breeches buoys and lifeboats to bring the crew and passengers to shore. Throughout the U.S., the lifesavers saved more than 178,000 people from 1878 to 1914.

Later, the Lifesaving Service became the modern day Coast Guard, while a new type of lifeguard emerged along the beaches.

Unlike the pool environments — which are virtually identical — open water beaches and

Kitty Hawk lifeguards and Coast Guard crew take off fins and gear after completing a rigorous training session in the Atlantic.

their related hazards vary dramatically from place to place. Crowd conditions, water currents, dangerous sea creatures, weather and many other factors contribute to these variations.

"Every beach has its own personality — energy, current pattern and beach slope," says Jim McCloy, associate vice president of research and academic affairs at Texas A&M University at Galveston and former Texas Sea Grant researcher. "Beaches also have their own culture."

Along the Outer Banks, many surfers congregate at the beaches.

Because of the rough surf, Outer Banks beaches — from Corolla to Hatteras Island — have beach rescue services in each municipality. From Memorial Day to the end of September, lifeguards sit in stands and also patrol the beaches in all-terrain vehicles (ATVs).

"Ten years ago, there were probably half as many lifeguards as there are now in Dare and Currituck counties," says Sandy Sanderson, Dare County's emergency management director. "The Outer Banks has taken the lead in North Carolina in innovative, proactive lifeguard services. The town of Nags Head was the first in the country in 1975 to use jet skis in formal rescue operations. They were also the first to incorporate an ATV beach patrol operation in 1979."

On a typical day, a lifeguard's work isn't as glamorous as on the old television series "Baywatch," according to Yeatts.

"We don't have drownings every day," he says. "It is real life and real emergencies."

At Kill Devils Hills, the lifeguards first get together for a briefing on the water temperature and surf. Then, they head for the beach where they check out the town's rescue equipment and umbrellas. All told, the town of Kill Devils Hills has 17 lifeguard stands, four patrolling ATVs and two trucks.

On Mondays, Wednesdays and Fridays, Kill Devil Hills lifeguards arrive at the beach early for physical training — from swimming and running to line pull drills and other exercises.

Mirek Dabrowski, owner of Surf Rescue that contracts lifeguard services for the town of Duck, says the hardest part of being a lifeguard is being "out in the sun all day and dealing with different weather conditions."

By the end of one summer season, the first-year lifeguards have matured a lot because of the enormous responsibility of the job, according to Tim Morrison, Kill Devil Hills ocean rescue support director. "They also meet people from all over the country and develop a great network," adds Morrison. "It's a great job."

Despite the intense training and sophisticated equipment, Yeatts says lifesaving is still the rescuer versus the ocean.

"It is so pure — fins, buoys and saving peoples lives," he adds. ◘

RESTAURANT SHOWCASES LIFESAVING MEMORABILIA

As a young boy, Lionel Shannon would often sit on the beach by the old Kill Devil Hills Coast Guard station and watch a captain re-enact a rescue with an old-time lyle gun.

"Capt. Pennel Tillett would scoop up a hole in the sand for his stomach and then lay down and line up the Lyle gun to fire it across the practice pole," says Lionel Shannon, one of the owners of Owens Restaurant in Nags Head.

Then the Coast Guard rescuers would use the shot line to pull out the block and tackle for the breeches buoy apparatus and pull in the victim, adds Shannon.

"From an engineering standpoint, I was always fascinated with how the Coast Guard could do so much with so little," says Shannon. "How many people today could rescue someone 500 yards off the beach in rough waters with simple beach apparatus? They used the same equipment again and again to rescue people."

Shannon's fascination led to his setting up displays of U.S. Lifesaving Service and Coast Guard memorabilia in the lobby and hall of Owens Restaurant.

The breeches buoy is one of the most frequently used tools employed in U.S. Lifesaving rescues during the 1800s, before the Coast Guard took over the service.

"The crew would run up the beach and pull the buoy in and out," says Shannon "The buoy has canvas seats for two victims."

The restaurant is filled with memorabilia from Coast Guard ships, including dress uniforms, china and a telescope.

"All of my family worked on the water," says Shannon. "One of my grandfathers was chief engineer of a Coast Guard ship. My other grandfather was a fisherman and farmer in Currituck County."

A framed 1933 *Coastland Times* article gives a glimpse into the drudgery and physical intensity involved in early lifesaving services.

"Five days a week devoted to drills at each station, boat drill, beach-wear drill, signaling with a wig-wag and semaphore, fire drill and drowning and resuscitation drill so that the crew are kept at a high level of efficiency which can be translated into action in case of emergency," according to the article.

— A.G.

Working the Waterway:
A Tugboat Tale

Story and Photos by
T. Edward Nickens

"You're starting to look all tugboaty,"

Captain Jimmy Donnelly says as I clamber up metal steps into the wheelhouse of the *Island Express*. It is my third morning aboard the tugboat, and I'm feeling tugboaty, too.

Bleary-eyed, beard-stubbled, and bed-headed, I'm functioning about half-speed given the restless few hours of sleep I just logged a few feet away from twin 800-horsepower Detroit Diesels. I glance out the wide wheelhouse windows at the marshes just south of Sunset Beach, green-gold in the early light, and take long sips of black coffee. And then I break out into a huge grin.

After all, what kid hasn't wished he could crew a tug, whether the inspiration is the cheerful Theodore Tugboat or, in my case, river pilots from the writings of Mark Twain?

I got my wish three days earlier, when I stepped aboard *Island Express* near Charleston, S.C. Operated by Stevens Towing Co., a family-owned shipping business dating to 1913, *Island Express* was bound for an Edenton, N.C., manufacturing plant that would turn the tug's barge cargo into nailing plates for framing joists.

To get there, we'd log days and nights on the Atlantic Intracoastal Waterway (ICW), a protected shipping channel that sneaks just inland of the coastline from Miami to Norfolk.

The ICW is the watery Route 1 of eastern America, in places a dredged canal through dense forest, elsewhere a marked channel crossing vast sounds or a tidal river flowing past industrialized waterfronts. Built for commercial shipping traffic, the waterway these days is just as likely to be plied by shrimp trawlers, sailboats, power yachts and even sea kayaks.

Tugboats, though, remain its most colorful users.

Threading the Gauntlet

Donnelly, a cherub-faced 47-year-old, has navigated the ICW for nearly three decades. He greets this sunrise while perched in a barber's chair bolted to the wheelhouse floor, and from which he can consider a large radar screen, rudder position gauge, wind direction, and tide all at once.

He grasps a joystick between his thumb and forefinger — it manipulates the tugboat's rudder. It is almost inconceivable that such a tiny apparatus is the primary means of steering such an elephantine rig, but Donnelly lines up the tug, the barge, and 4.5 million pounds of galvanized steel for the run through the heavily developed stretch of waterway behind Sunset Beach.

On each side of the narrow canal, docks bristle like teeth in a comb. "Every year there are more of 'em," Donnelly grimaces. "A lot of places that were wilderness 10 years ago are lined with houses and docks. Now, there's no place to go if something goes wrong."

I watch, spellbound, as he calmly threads 315 feet of tugboat and barge through a gauntlet of docks. It reminds me of something his boss, Boz Smith, told me when I asked about the personalities of his tugboat captains. Smith knew I was after colorful tales, but he shook his head. The wheelhouse of a tug, he said, "is no place for a gunslinger."

Continued

LEFT: In the belly of a barge, 3,000 tons of new steel dwarf mate Thomas Hutson.

TOP: Keeping lines straight keeps mate Thomas Dingee on the move as tug and barge chug through cypress-lined river passages.
BOTTOM: Pushing from behind, tugs are lashed and cabled to barges with oversized gear. Here mate Thomas Hutson checks the connection.

That's because barge-pushing tugboats handle heavy, bulky, expensive cargo. Tugs push barges laden with stuff impractical to move via transfer truck or rail — super heavy transformers, entire bridge beams, 1,000-foot pipelines, and in our case, 22-ton steel doughnuts. To move our load via transfer truck would have required 106 trips — or 106 trucks. Over the years, Donnelly has hauled "a bunch of crazy stuff," he says. Sonar domes for submarines. Vintage airplanes. A 7,500-square-foot plantation house. And lots of ammunition for the armed forces.

"Everything from rockets to cruise missiles to bombs," he laughs. "But we're not supposed to know that."

All told, according to the U.S. Army Corps of Engineers, tugboats took 17,612 trips on the ICW in North Carolina in 2000, moving 1,614,000 tons of cargo.

Donnelly pilots this load from a wheelhouse perched 28 feet above the water. It's a million-dollar view. As the tug chugs north up the waterway, small flocks of glossy ibis wheel over the barge, and wheat-colored salt marsh gives way to dark woods. At one point, a pod of porpoises suddenly appears beside the tug. Donnelly's eyes light up. "They always look like they're so happy to see you," he croons.

From his tug, he watches duck hunters setting decoys in the wan light of morning. He's seen wild hogs, manatees, black bear, and an alligator that swam up and bit the fender tires hanging off the side of the ship.

Once, crossing Albemarle Sound, the crew braced for a huge band of rain picked up by the wheelhouse radar. "We watched it come, got ready for the storm, but when it got to us it was mosquitoes," Donnelly says. "Billions of them, boiling out of the woods at Coinjock. The wheelhouse was covered. The engine breathers sucked so many in that we had to stop and clean them out."

Tar Heel Trek

North Carolina's stretch of the waterway involves some of the most intriguing — and challenging — portions of the entire route, and not only because of prodigious insect life. Although maintained channels score a number of tidal rivers and sounds, the official number of ICW miles in North Carolina totals 308.

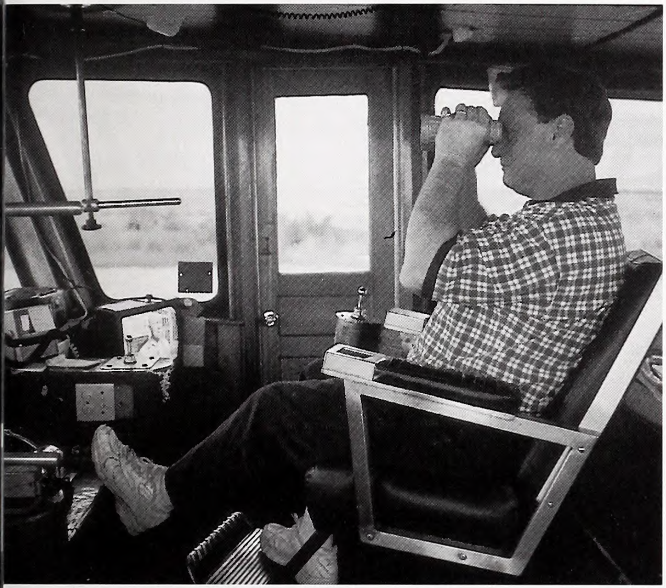
From Bird Island on the border of the Carolinas, the waterway skirts the marshes behind Sunset Beach and Ocean Isle, Holden Beach, Long Beach and Oak Island. From there the waterway turns north, following the mouth of the Cape Fear River to Snow's Cut, a deep, dredged, razor-straight canal that spills into Myrtle Grove Sound behind Carolina Beach.

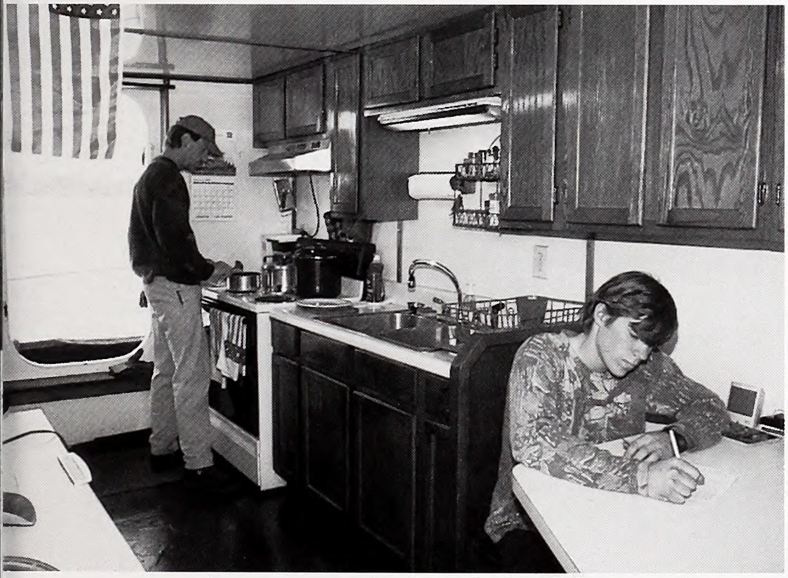
Trending north the rest of the way along the state, the ICW sneaks behind barrier islands as frequently as practicable, but still it must cross the big, open waters of Pamlico and Albemarle sounds, among the most challenging stretches of its entire length. After crossing Albemarle Sound waterway, captains have a choice of routes: through the Great Dismal Swamp via the Pasquotank River or up the Coinjock Canal and Currituck Sound. Both routes wind up at Norfolk, the official end of the ICW, although dredged channels continue north.

Along the way, there's plenty of time to gawk, for few things happen quickly on a tugboat. Depending on the tide, *Island Express* moves along at a ponderous three to eight knots an hour. Each crew member works six hours on and six hours off, for 17 days aboard.

While Donnelly and mate Frank Litaker trade shifts at the helm, deckhands Thomas Dingee and Thomas Hutson monitor engines and check every onboard rope, cable, and light. There's plenty of deck-swabbing, to be sure. Each surface and window is mopped or scrubbed at least once during each 24-hour period.

One afternoon I watch Dingee clean the tops of spice bottles with a wet paper towel. "It's not a yacht," he says, in a deep, quiet tone. "But it's home for most of the month." Still, it's not all housework and tedium.





TOP: Tugboat captains think — and look — far ahead of their 300-foot-long tandem vessels. Scanning the tide at a distant inlet, Captain Jimmy Donnelly starts figuring the angles.
BOTTOM: It's all hands in the galley for tugboat crews. Each man takes his turn cooking dinner, and no one is accused of going hungry.

Weather Woes

Around midnight on our first night out, the wind roars from the northeast, ripping free the huge blue tarps that cover the steel coils.

I hustle down a tall ladder into the belly of the barge behind Hutson, freshly turned 21, with bangs that fall into his eyes. We wrestle with wind-lashed tarps and guy lines as clouds of rust dust clog our throats and coat us head to toe with a gooey brown slime.

An hour-and-a-half later, we wearily pull ourselves back up the ladder and climb the metal steps into the wheelhouse. Donnelly flips on a 1,000-watt spotlight. "Sorry, fellas," he says, nodding towards the barge. More tarps have ripped free. We clamber back down the steps just as the rain comes.

At sunrise the next morning, we're making steady progress through the marshes of McClellansville, S.C., with the Cape Romain lighthouse a distant smudge to the east. We cross the mouth of the Santee River, then turn up wide Winyah Bay. The wind is blowing 30 knots, pushing up four-foot-tall breaking waves that bash into the barge and send tremors through the tug, but Donnelly is unfazed by the rising wind.

He tells me about one particularly hairy crossing of the Chesapeake Bay in the middle of a big freeze, with the blips from small icebergs dancing across his radar. We talk about the difficulties of shoaling in the ICW and the pleasure yachts that seem to grow larger every year.

"They don't slow down — they think we're so big that their wakes won't mess with us," he groans. "But some of their wakes are so big they go right into our engine doors. They can break the lines that hold the barges together."

Around lunchtime I make my way to the tugboat galley. It's a full-sized kitchen tucked into the tug's warren of tiny rooms, outfitted with a chest freezer, refrigerator, and cabinets packed with $500 worth of groceries.

When I arrived on *Island Express*, I expected pork and beans. Instead I gorge on Cornish hens, steak and collard greens. "You'll gain 10 pounds on this trip," Litaker told me earlier. "Cooking is our primary means of entertainment."

In the galley, young Hutson sits in the single booth, reading a love letter from his girlfriend. Tugboating is hardly a carefree life on the water. During my tugboat stowaway, I ask each crew member about the toughest part of the job. All of them speak of home.

"Deckhands come through for a few days, and it's not what they thought it would be," Dingee explains. "Being away from home is the hard part."

Litaker frowned when I posed the question. From the wheelhouse cell phone, he just had given his 15-year-old stepdaughter a long-distance talk about school. The schedule, he says, "is tough on everybody."

Donnelly works hard to keep fast the line between home and the helm of *Island Express.* That night he's back on watch in the wheelhouse, with a small television set tuned to "Jeopardy!"

Every night, he tells me, he watches the show, and every night his wife, Alice, calls him right after the "Final Jeopardy!" question is posed. "We can be five states apart, but she always knows where to find me."

As if on cue, his cell phone rings. He grins and picks it up. "Hey, there!" he says, then pauses for a moment. "Nope. Slide rule. Don't ask me how I remembered that."

He chats for a few moments in a hushed tone, telephone in his left hand, joystick cradled between the thumb and forefinger of his right. Then it's time for goodbye. "I'll talk to you tomorrow night," he says. "I'll be right here." Wherever that happens to be.

Continued

TOP: *Captain Jimmy Donnelly grits his teeth on the approach to crowded Wrightsville Beach.*
MIDDLE: *Passing under the Wrightsville Beach drawbridge.*
BOTTOM: *When it comes to character and curiosity, few craft surpass tugboats.*

Skimming the Shoals

As the *Island Express* enters the mouth of the Cape Fear River — which is humming with boat traffic — we meet tugs pushing pig iron, oceangoing fuel barges, the Southport-to-Bald Head Island ferry, aluminum fishing skiffs and 50-foot big game boats bound for offshore waters.

Flocks of cormorants skein the sky over the Sunny Point Military Ocean Terminal, a frequent port-of-call for Donnelly during the Gulf War. We thread the narrow Snow's Cut, and by mid-day approach the heavily developed ICW waterfront at Wrightsville Beach. Litaker is at the helm. "It's a billion-dollar row through there," he grimaces. "Million-dollar boats, lined up everywhere."

But there's another, more pressing obstacle in front of us. Behind Masonboro Island, the waterway channel narrows considerably, and Litaker sits bolt upright in the chair.

I see the sandbars off to each side, leaving a narrow slot for the tugboat and barge to pass. Then I feel the tug bog down, and watch the depthfinder gauge plummet from 11 feet to 4.3. Our speed sags from 4.3 knots to 3.6.

"Come on, baby, come on. Keep going," Litaker intones, his eyes flitting from the channel outside to the gauges in the wheelhouse. We slow to 2.8 knots, then 2.5. Huge plumes of sand trail behind the tug.

"We're knocking the barnacles off the bottom now," Litaker says, gritting his teeth. The strain on the engines sets up a series of rattles inside the wheelhouse — the instrument panel and door handles buzz like bees as the belly of the tug groans across the shoal.

It's a hairy few minutes — going aground on a falling tide could mean hours of delay, not to mention the aggravation of blocking the main channel for other traffic. Navigating shoals is an increasing problem along the ICW, Litaker says, as money for dredging gets harder and harder to come by.

Then, just as forward motion nearly ceases, the depthfinder readout finally gives us good news. The bottom drops to 5 feet, then 6. Slowly we regain speed, and Litaker relaxes in the chair.

"Now all I have to worry about is not taking out a few million-dollar boats at Wrightsville Beach," he grins.

But it's the end of the watery road for me. I have a ride back to Raleigh waiting at the public boat ramp just south of Wrightsville Beach, and Litaker waves down a passing boat to give me a lift to shore. *Island Express* has another day-and-a-half of steaming to complete before docking at Edenton with a delivery of nearly 3,000 tons of freshly minted metal.

It's another day-and-a-half of fighting full-moon tides and dodging crab pots in a tug-and-barge combination that's longer than a football field.

As I jump ship from the tug to a 25-foot center console pressed into taxi service, I can't help but wonder what other sights the crew will see as they cross the open sounds, and what I would see along the Alligator River swamps from an aerie perched three stories above the water.

At Wrightsville Beach, as luck would have it, my buddy and I are caught by the drawbridge that raises to let *Island Express* pass. I hop out of the car and run a few steps to the bridge railing, then whoop and wave to the crew as they clear the bridge.

Donnelly waves from the wheelhouse and gives me a salute as drivers gawk from their stopped cars. I grin like a kid. After all, I may wonder what the next 36 hours will hold for *Island Express*. But at least I know what it's like to ride a few miles in a tugboater's shoes. ◘

Capstone Students Experience Diversity of Albemarle Region

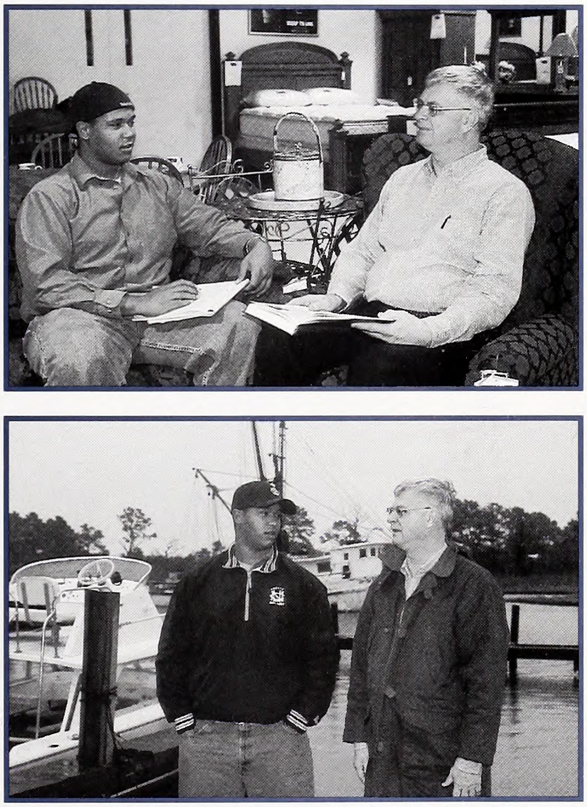
By Ann Green • Photographs by Michael Halminski

As a youngster, Sennai Habtes listened to his mother spin Caribbean folk stories about imaginary characters — from a headless crab to a hog that is transformed into a man.

After hearing such tales in his native St. Thomas in the U.S. Virgin Islands, Habtes developed an "appreciation for oral history and other peoples' points of view."

"I am naturally interested in what people have to say," says Habtes, a senior at the University of North Carolina at Chapel Hill. "This comes from my mother. Her stories are primarily folk stories about characters that take on human characteristics. I am attracted to these stories because they often have hidden meanings."

As an intern at the Albemarle Ecological Field Site in Manteo for UNC-Chapel Hill's Carolina Environmental Program (Capstone), Habtes used his interviewing skills to conduct a study about how tourism has affected residents' lives in coastal Hyde County.



TOP: Sennai Habtes interviews R.S. Spencer about the impact of tourism on Hyde County. BOTOM: R.S. Spencer has developed a deep appreciation for the heritage in Hyde County.

Habtes was one of nine Capstone interns who spent a semester in residence at the Albemarle Field Site. Through the program initiated in 2001, the UNC-CH undergraduates develop an appreciation of both the natural and cultural diversity of northeastern North Carolina.

"The program is great because it helps students get involved in the real world where people are making a living and also are trying to protect the environment," says North Carolina Sea Grant extension director and coastal tourism specialist Jack Thigpen. "You have to have a balance between economic development and conserving nature."

ORAL HISTORY INTERVIEWS

Under the direction of Thigpen, Habtes interviewed five residents of rural Hyde County, including a local merchant, chamber of commerce director, agricultural extension agent, fisher's wife and retired bank president.

The report also highlights the economic impact of tourism in coastal N.C. counties.

"For all coastal counties except Camden, there has been an increase in revenue from tourism," the report says. Hyde County's annual wages paid from tourism-based services jumped 136 percent from 1993 to 2000, according to the North Carolina Employment Security Commission. However, the largest increase in annual wages for tourism services was in Currituck County, with a 351 percent increase, followed by Dare County, with 319 percent.

Habtes conducted the interviews in Engelhard, Swan Quarter and surrounding

Continued

areas of Hyde County, which historically "has been considered one of the poorest counties within the state of North Carolina," according to the report. Until the tourism industry developed, most people fished, farmed or operated hunting businesses for a living.

"The oral history interviews are in no way expected to encompass all views regarding the communities of Hyde County," wrote Habtes. "They are, however, like all aspects of this report, expected to provide a snapshot of the often complicated role of tourism in coastal areas."

Residents recognize their heritage in Hyde County as important and want to keep local traditions, such as making ponebread that is sweetened with molasses.

"If I go to a church bazaar here, I look for ponebread," says merchant R.S. Spencer. "But you go 50 miles from here either way, and you won't see ponebread, and you either like it or you don't."

"And that's just one of the values, and there are things from the past that we need to preserve, and I think that we as citizens today have the responsibility to preserve the past, to write it down, to tell it to our children and grandchildren," adds Spencer. "But that doesn't mean we want to go back to using ringer washers and horseback instead of cars."

RESIDENTS' VIEWS

The residents also are satisfied with living in a remote location and the standard of living, according to the report.

"We make out just fine, and we love how we live," says Gwen Newman, whose family income is based on commercial fishing. "So we don't need a new Mercedes in the driveway. We're happy."

The group voices concerns about outsiders buying property traditionally used by hunters, thus making the recreational activity unaffordable for many.

Mac Gibbs, a North Carolina Cooperative Extension agent, says that he doesn't have the money to use the hunting areas bought by nonresidents.

Under the direction of program director William Stott, Capstone interns spend a semester at the Albemarle Field Site in Manteo.

Hunting has gotten into such "big money that the local people can't afford to do it," says Gibbs. "If you don't own a piece of land that you can hunt on, then you won't hunt here. So you go somewhere else to hunt."

To maintain the unique character and valued traditions in Hyde County, the residents feel that the community leaders need to work together to create a strong infrastructure.

"I think that if we don't do something about getting some zoning laws and regulations in here, and we don't have a plan," then somebody with money will come and do what they want, says Margie Brooks, executive director of the Hyde County Chamber of Commerce. "And maybe they'll turn it into another Orlando, Florida, and we don't want that."

OTHER CAPSTONE PROJECTS

In addition to Habtes' tourism project, Capstone students tackled a variety of topics related to water in the Albemarle region — from a blue crab enhancement program and habitat studies at Jockey's Ridge State Park to a septic health initiative with the Town of Nags Head and an oral history of charter boat captains at Oregon Inlet.

"I met some incredible people in the fishing community," says UNC-CH student Jason Kemp. "The charter boat captains are so hard working and committed. There is a sense of fraternity that exists along with the competition for fish. Someone's boat burned down, and everyone passed around a hat to help the fisherman get back on his feet."

Kemp also got a glimpse into the captains' home lives.

"Some wives got up at 3:30 in the morning to fix their husbands' breakfast and lunch," says Kemp. "They were often part of the business and also took care of the home."

For a project on pelagic birds, Tiffany Kiernan ventured on a boat deep into the Gulf Stream.

"It was fun," says Kiernan. "I used binoculars, an official counter and headphones to collect data on seasonal migration of sea birds. It was a really rewarding opportunity. I had the chance to experience pelagic birding as a tourist and as a scientist. I learned how to identify different seabirds and served as the official counter for one trip, recording the data on the seasonal variation of seabirds."

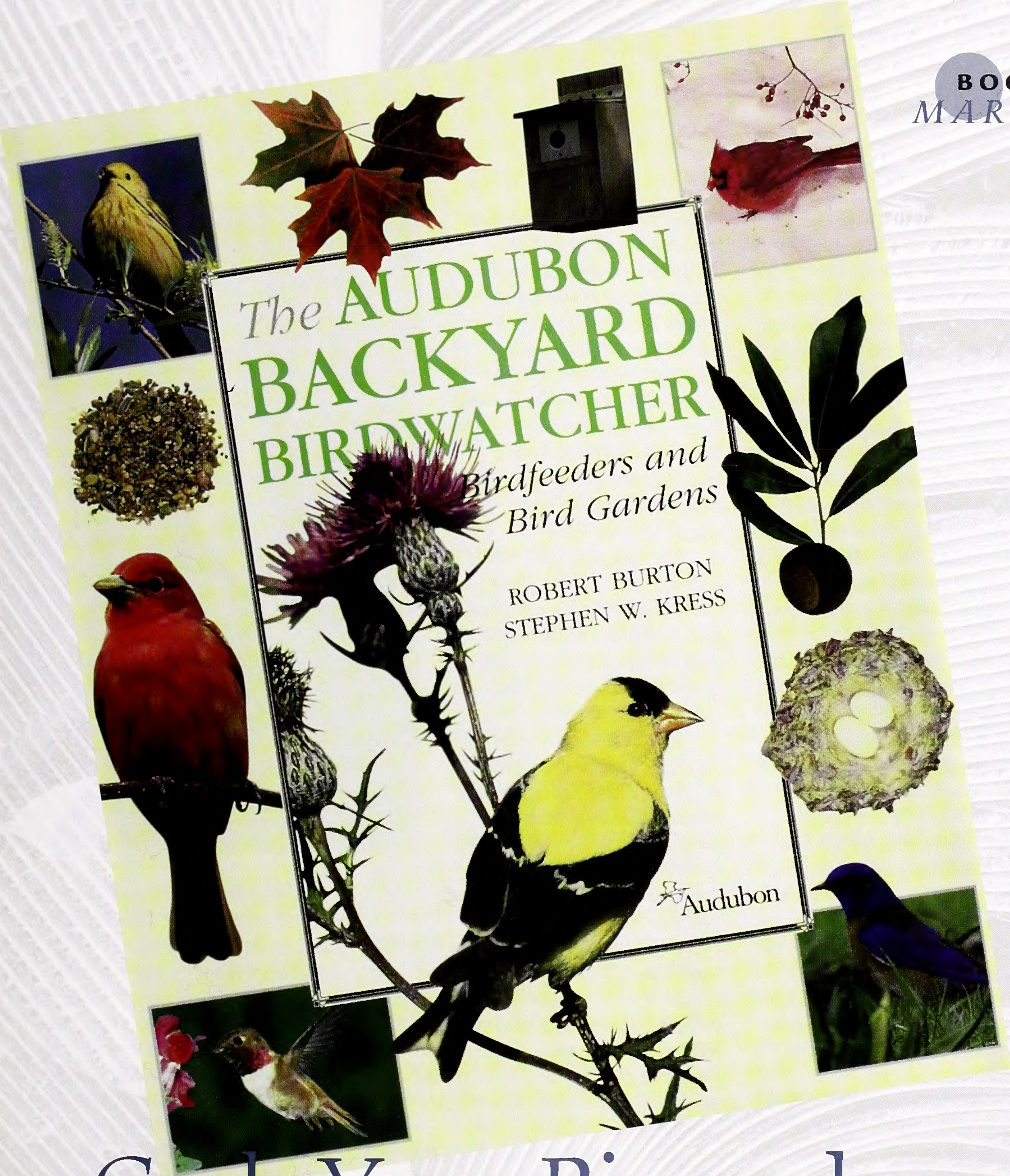
To deepen students' understanding of the Albemarle region, the students trekked on weekly field trips to a variety of places, including the Great Dismal Swamp and the Alligator River National Wildlife Refuge.

"It is great to see things in the open," says Habtes. "I walked in deep water through the Alligator National Wildlife Refuge. It took me outside my comfort zone. I even heard wolves howling."

Habtes says he benefited in many ways from the program.

"It was a new experience to take classes in a small setting and have such direct access to professors," he says. "I also learned what it is like to be in the working world." ▣

For more information about the Capstone project, call 919/966-9922, e-mail cep@unc.edu *or visit the Web:* www.cep.unc.edu.



The AUDUBON BACKYARD BIRDWATCHER

Birdfeeders and Bird Gardens

ROBERT BURTON
STEPHEN W. KRESS

Audubon

Grab Your Binoculars, the Birds Are Coming

By Pam Smith

If seeing a flight of pelicans precision dive into near-shore waves doesn't excite you, then, read no further. Or, if you have never pulled your car to the side of the road to watch a pair of wading birds at rest in a salt marsh, then this is definitely not your fare. And, if you don't think a bluebird choosing your homemade bluebird box gives you bragging rights, then stop right now.

Continued

On the other hand, if you are one of the hundreds of thousands of bird watchers in America — or would like to be one — then read on.

Inspired by the folks at North Carolina Audubon who are celebrating their century milestone, we went looking for books that could help our readers get involved in what has become a favorite national pastime.

The unique thing about bird watching is that it can be a family affair or a solitary activity. It also requires very little special equipment. Inexpensive binoculars will suffice for backyard viewing. And, oh yes, a book that helps you identify some of your backyard visitors can kick enjoyment up a notch.

As they say in football stadiums, you can't tell the players without a program. (I keep *The Audubon Society Field Guide to North American Birds* on a shelf near my kitchen window that looks out over the back yard — and its five or six bird feeding stations.)

The National Audubon Society offers opportunities to become "citizen scientists" by participating in a number of bird count events each year, such as the Christmas Bird Count. (See information box on Page 11 that accompanies the story about Audubon.)

There are plenty of books in the library or your local book store to introduce you to the world of bird watching. But be careful. It could be habit forming.

Say, is that a Rose-breasted Grosbeak that just perched? Hand me my book.

- **THE AUDUBON BACKYARD BIRDWATCHER: BIRDFEEDERS AND BIRD GARDENS** by Robert Burton and Stephen W. Kress. 1999. A DK Publishing Book. 5880 Oberlin Drive, San Diego, CA 92121. 381 pages. Hardcover, $19.98. ISBN 1-57145-186-2.

The Audubon Backyard Birdwatcher truly is for beginners who don't know a robin from a Blue Jay.

From the start, author Stephen Kress lets readers know that bird watching is fun, but serious fun. Kress is manager of Audubon Society's Maine Coast Sanctuaries and is director of its Seabird Restoration program. He writes: "The best place to start helping wildlife is on our own property. … Each of the 9,000 bird species sharing the Earth with us is an irreplaceable treasure whose songs, colors, and vibrant energy enrich the human experience. Only a knowledgeable public can guarantee a future for all the species we know today."

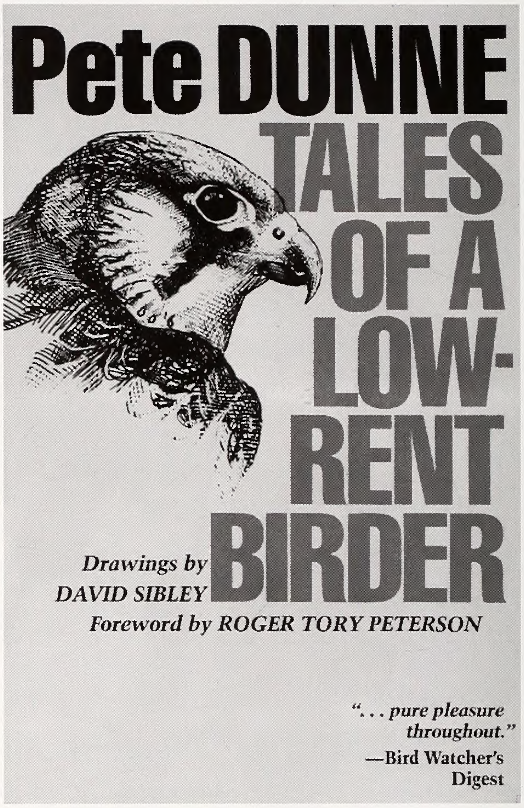
The book, richly illustrated with more than 1,000 color photos, shows how to identify and attract birds. It provides profiles of the most familiar garden birds, with details of their nesting habits, songs and feeding preferences.

Loss of wild countryside to development means that creating miniature wildlife reserves is more important than ever, the authors point out. But if you want to attract birds, go easy on the pesticides. Poisoning worms and insects birds eat could indirectly kill the birds.

The section on landscaping for birds is a book in itself, filled with information on creating a year-round destination for birds by manipulating vegetation succession and building physical structures. Descriptive passages accompany easy-to-understand planning illustrations and regional (zone) planting guides.

And what of those backyard feeders, do they really help birds? The authors say that several species definitely benefit from extra food sources, especially in severely cold weather. Summer supplemental feeding also is helpful, they say, since it takes extra energy for parent birds to gather food for their young.

There are as many kinds and sizes of feeders as there are kinds of birds, or so it seems from the pages of suggested feeder types. For the truly ambitious birder, the authors provide how-to instructions for building feeders and houses.


Pete DUNNE
TALES OF A LOW-RENT BIRDER
Drawings by DAVID SIBLEY
Foreword by ROGER TORY PETERSON
". . . pure pleasure throughout."
—Bird Watcher's Digest

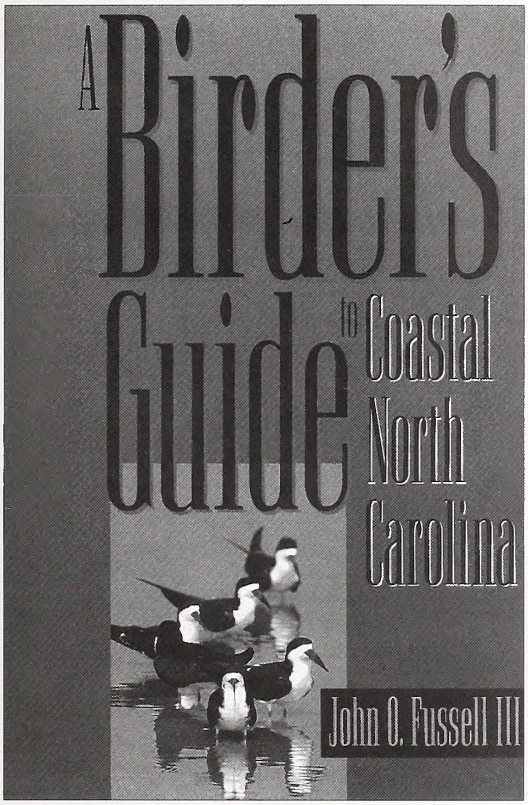
Perhaps the most fascinating chapter deals with bird behavior. "The different ways birds feed, fly, walk, communicate, nest and migrate show how they have evolved to make the most of their environment," writes the author. Did you know Green Herons have learned to use bait when fishing?

In short, it's a virtual encyclopedia of information for beginning or veteran birders.

- **TALES OF A LOW-RENT BIRDER**, by Pete Dunne, with illustrations by David Sibley. 1986. University of Texas Press, P.O. Box 7819, Austin, Texas 78713. 157 pages. $11.95. ISBN 0-292-71574-9.

Tales of a Low-Rent Birder is a humorous take by this serious birder. Dunne is director of the New Jersey Audubon Society's Cape May Bird Observatory, and a consultant to the Peterson birding field guide series.

He is well known in ornithology circles for his serious studies of hawks. He is better known by his readers for his wit. Consider



the title of another of his works: *Small-Headed Flycatcher. Seen Yesterday. He Didn't Leave His Name.*

This book is a collection of articles he wrote between 1977 and 1985, that appeared in *Peregrine Observer, Bird Watcher's Digest* and *New Jersey Audubon*.

The collection includes his encounter with a 92-year-old man in New Jersey who wanted to trade stories with Dunne about how many hawks he had killed. Their meeting had gotten off with a misunderstanding about why Dunne was interested in spotting the northern harrier, better known on the Jersey shore as the chicken hawk. "I shoot 'em every chance I git," the old-timer proudly announced.

Dunne chose not to do battle. "Just as Billy is a product of his time, I am a product of mine," he writes.

On a lighter note, he tells the tale of "A Lifer for Roger." The five-member team is in hot pursuit of a Fork-tailed Flycatcher. They had been instructed to look in the backyard of "the house across the street from the house with the blue whale."

He was willing to give up the search. But being a member of a five-man team, he could not make a unilateral decision. Besides, one team member just happened to be Roger T. Peterson, the author of Junior Audubon Society bird identification leaflets. Peterson, now deceased, was Dunne's boyhood hero. How could he deny him a chance to check this rare bird off his lifelist?

And so the quest for the holy grail begins, with comical twists up to the conclusion of the adventure.

Dunne knows the obsessions that drive birders to follow vague directions from total strangers who claim to have spotted a rare species two days ago.

While he is laughing at himself, Dunne is teaching his readers about birds and birding.

- **A BIRDER'S GUIDE TO COASTAL NORTH CAROLINA**, by John O. Fussell III. 1994. The University of North Carolina Press, P.O. Box 2288, Chapel Hill, N.C. 27515. 540 pages. Paperback. $19.95. ISBN 0-8078-4453-5.

If you are heading for the North Carolina Coast, don't leave home without a copy of *A Birder's Guide to Coastal North Carolina.*

Even if you consider yourself an "accidental" birdwatcher, this book gives an overview of the possibilities in store.

"Coastal North Carolina provides wonderful opportunities for bird-watching. The region contains an excellent variety of habitat, and over four hundred species have been identified in the area, although the area has a handful of acive birders and is actually not birded very heavily. New species are found almost every year," he writes.

Fussell points out that North Carolina's geographic position — and the offshore presence of the Gulf Stream — set the stage for a diverse display of species.

He laments the loss of coastal habitat to development, but rejoices in the fact that "much critical habitat is being preserved in public lands — the national seashores, national wildlife refuges, national forests, state parks, state estuarine reserves and state game lands." In addition, conservancy groups protect an abundance of natural areas.

This opens the door to opportunities to get close to nature without straying on posted property. All the areas he discusses in the book are public lands.

For starters, Fussell provides an annotated list of the birds you may see, along with the location and description of usual habitat. And, oh yes, if you happen to be doing some deep-sea fishing, Fussell includes some fascinating information about sea birds you may encounter offshore.

Site guides are arranged from north to south. Maps help readers find their way to the birding possibilities. The author's personal experiences are noted.

For example, Map 5 in "The North Coast Section" introduces Merchants Millpond State Park in Gates County to readers.

He describes Merchant Millpond as "one of the most beautiful areas in coastal North Carolina" — a place to enjoy even when the birding is slow. The towering bald cypress and tupelo gums dripping with Spanish moss are home to Red-shouldered Hawks, Barred Owls, Pileated Woodpeckers, and even a few Wild Turkeys.

How easy is it to get to the best birding spots? For each entry, Fussell provides logistical information that will keep travelers from bogging down in swamp or sand. He also tells the time of year to sight the usual and unusual species.

For readers "hooked" on birding, Fussell devotes an entire section on Birds of Special Interest to help identify and find more elusive, rare birds.

Exploring the Ocean Blue

By Katie Mosher

The Steeples area. The *Lophelia* Reefs.

Can't place these exotic locations off the Carolina coast? Just ask countless teachers and students who followed the "Islands in the Stream 2002" research expedition through online logs.

The daily journals often reflect the excitement of twice-daily submersible dives. But there's much more to these missions that are sponsored by the National Oceanic and Atmospheric Administration's Ocean Exploration program.

"We work the whole water column," says Steve W. Ross of the N.C. National Estuarine Research Reserve, leader of the team that designed the second leg of the three-part voyage. "The sub is just one piece of gear we use — and it is more vulnerable to weather," he adds with a knowing nod.

When the weather cooperates, the sub provides spectacular views of deep-water habitats, as it can drop to 3,000 feet below the surface. But to find The Steeples off North Carolina's southern coast, the sub had to dive less than 400 feet, four times deeper than most scuba divers venture.

The Steeples area includes large, irregular boulders and ledges — pieces of the continental shelf broken off by erosion and geological events and scattered by storm currents, the scientists explain. The warm Gulf Stream current transports fish larvae and encourages a dominance of tropical reef fishes.

During an expedition in 2001, researchers reported sightings of several fishes that were previously not found north of Florida, several fishes new to the United States, and many species thought to be rare — thus prompting the return visit.

"This dive added another up-close and personal look at this fauna, and new information on the overall community that supports an important food fishery," says Ken Sulak of the U.S. Geological Survey.

In the 2002 voyage, the scientists also revealed secrets of the *Lophelia* Reefs, located in much deeper waters, about 80 nautical miles south of the team's study sites at an area off Cape Hatteras known as "The Point."

"These are not the familiar colorful corals of shallow reefs, but are very slow-growing stony corals adapted to life in dark, cold waters. They lack the light-dependent symbiotic algae that impart color to reef-building corals in tropical seas," explain Sulak and Ross.

While they are delicate, the corals can live 1,000 years or more. "Together, the ridges and reef mounds, which may rise as much as 150 meters from the surrounding substrate, act to accelerate bottom currents — a condition favorable to species that filter-feed on current-borne plankton," the scientists add.

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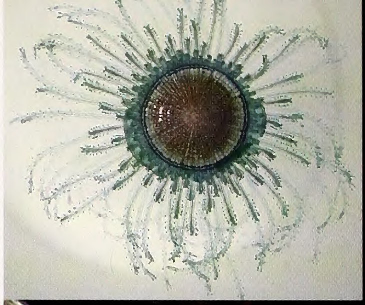
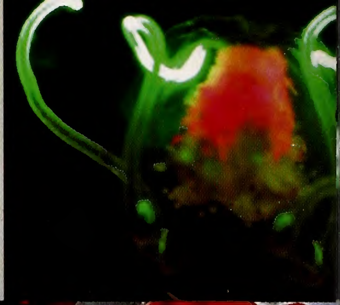
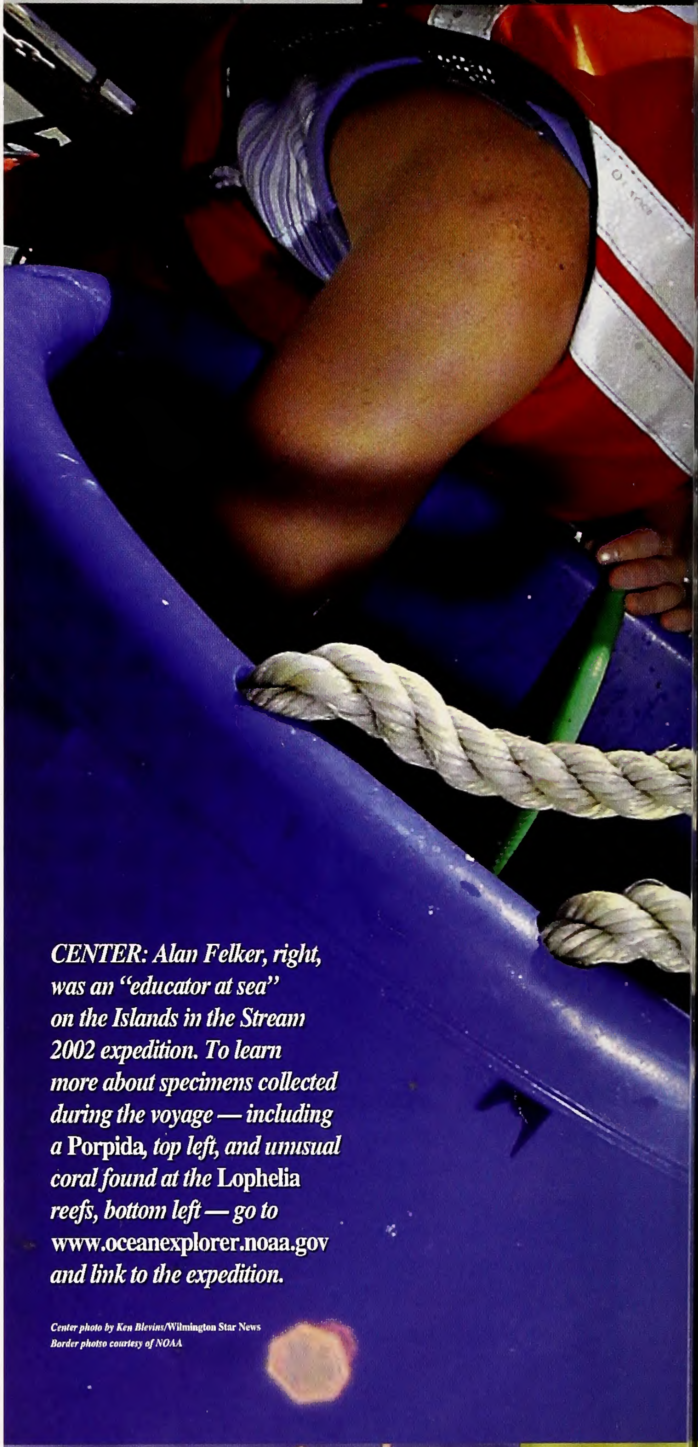
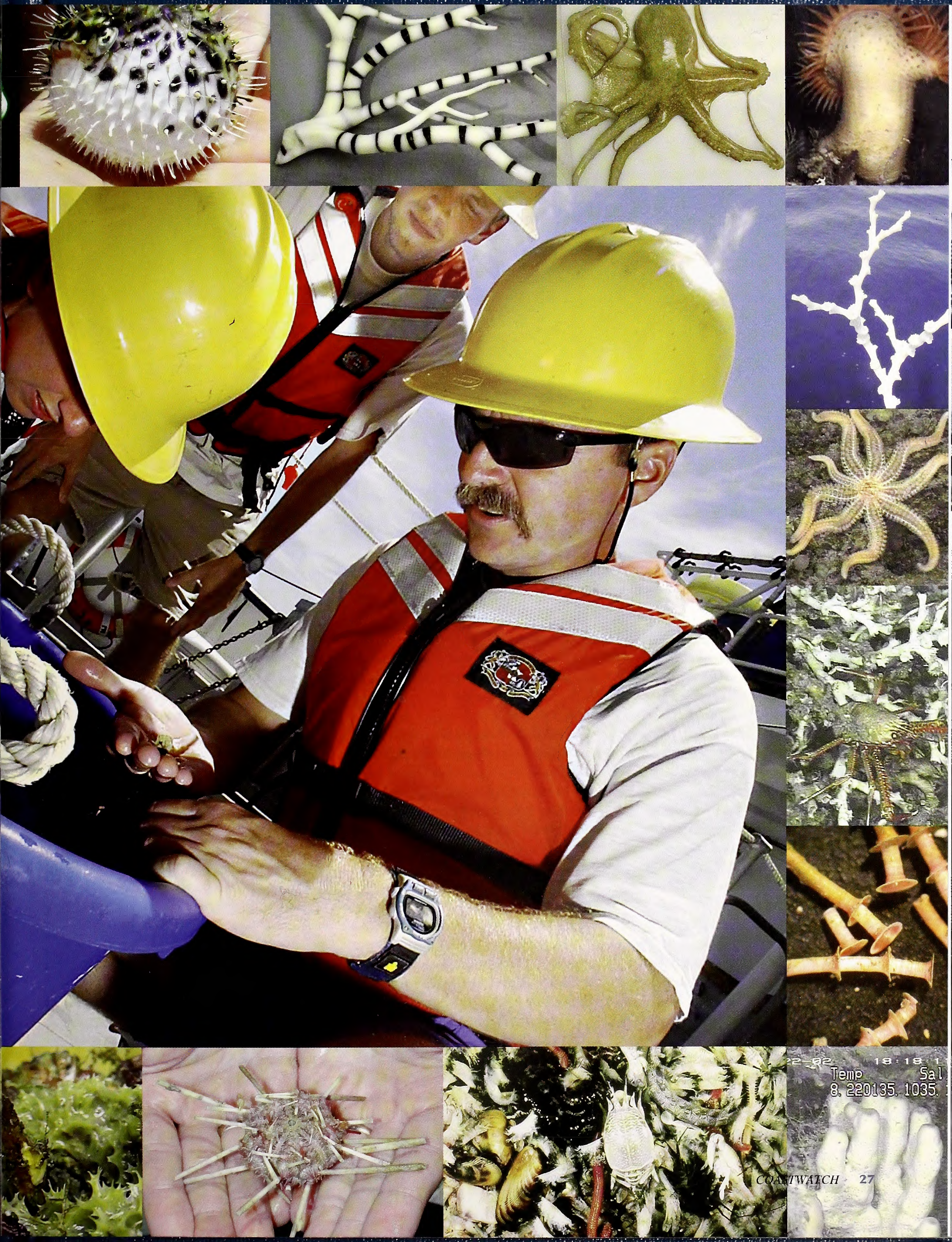






CENTER: Alan Felker, right, was an "educator at sea" on the Islands in the Stream 2002 expedition. To learn more about specimens collected during the voyage — including a Porpida, *top left, and unusual coral found at the* Lophelia *reefs, bottom left — go to* www.oceanexplorer.noaa.gov *and link to the expedition.*

Center photo by Ken Blevins/Wilmington Star News
Border photos courtesy of NOAA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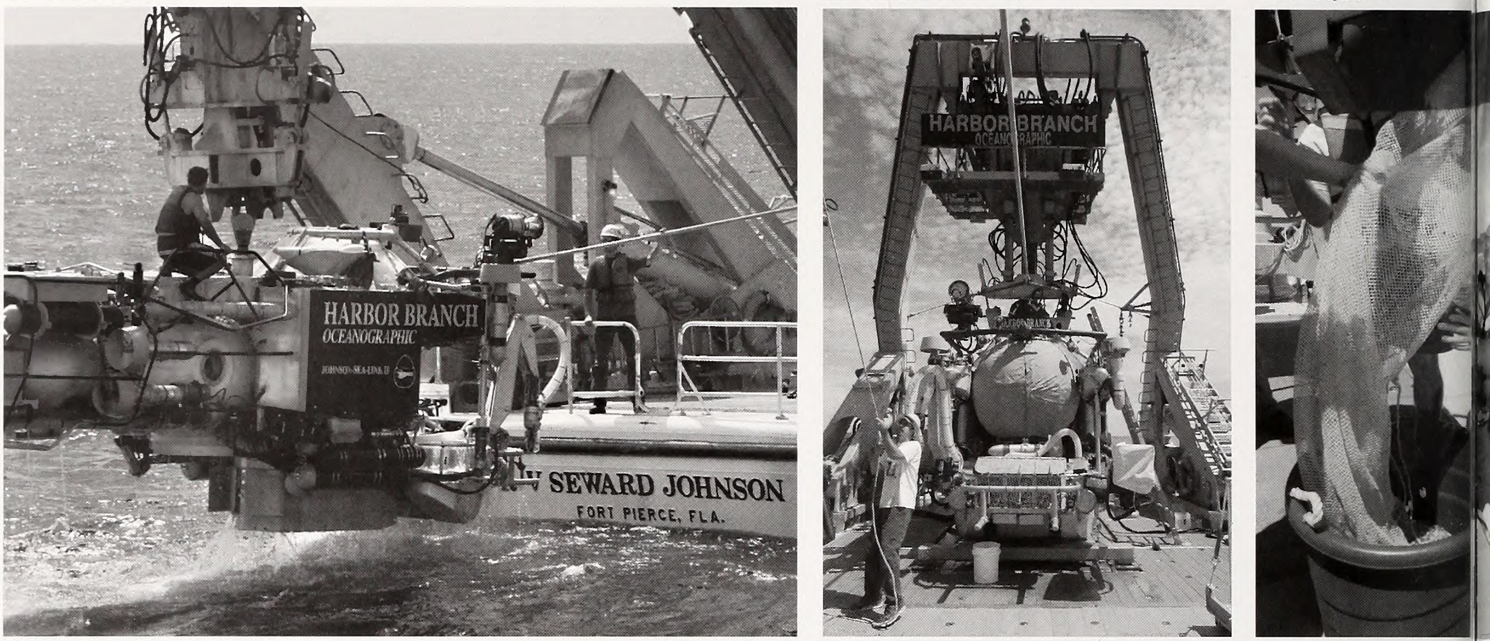


Ken Blevins/Wilmington Star News

Ken Blevins/Wilmington Star News

Ken Blevins/Wilmington Star News

LEFT TO RIGHT: Skill and precision are required to manuever the submersible Johnson Sea-Link II *on and off the* R/V Seward Johnson. *The sub offers cramped quarters, but spectacular underwater views. Jonathan Hartsell adjusts sampling gear.*

A WORKING CRUISE

The days are long for the 19 researchers plus crew aboard the *R/V Seward Johnson* and its submersible vessel the *Johnson Sea-Link II,* which are based at Harbor Branch Oceanographic Institution in Florida.

The schedule for this particular mission is set by Ross and Sulak, as well as Liz Baird of the N.C. Museum of Natural Sciences and Fritz Rodhe of the N.C. Division of Marine Fisheries. Their team includes graduate students and Alan Felker, a seventh-grade teacher from Boone who also teaches at Appalachian State University.

Aboard ship, data are collected and analyzed in four shifts. For example, Felker works from midnight to 6 a.m. and again from noon to 6 p.m. The work not only enhances his knowledge, but also allows him to be a role model for his students.

"Through activities such as this expedition, we hope students will see the large variety of occupations that the scientific community offers," Felker adds.

While in the compact submersible, the scientists use sophisticated still and video cameras to record activity. They also audiotape personal observations.

"That is why you are there — to accurately extract information," Ross explains. "Video is a great permanent archive of the animal's behavior."

Back in the shipboard lab, the team reviews the videos and selects clips to place on the Internet.

In addition to the cameras, the sub has a collection system that allows researchers to fill up to 12 buckets during each dive. Meanwhile, a variety of sampling gear is used throughout the day and night — surface trawls that reveal the *Sargassum* communities, otter trawls or tucker trawls that work at varying depths, even a small "sled" to take benthic samples.

Specimens vary. The bounty may include a *Porpida*, which has tentacles and is related to the jellyfish. Another catch includes hundreds of brittle stars.

"Every time we put a piece of equipment in the sea, we learn something new," says Baird, who daily would review e-mail questions sent by students of all ages.

"They ask questions directly related to our experiences the previous day," she adds.

A DIFFERENT PERSPECTIVE

Traditionally, fisheries stock assessments have utilized models that draw upon data gathered through trawling samples. But in many locations, the high-profile reefs prevent research trawling. "If they can't trawl, they can't get fish counts in these habitats," Ross says.

That means the submersible trips offer the only sampling possibilities for certain areas. But the scientists are after more than fish counts. They are looking at the ecology, community structure, food chain relationships and other factors. "Who's eating whom? Where does the food come from?" Ross questions.

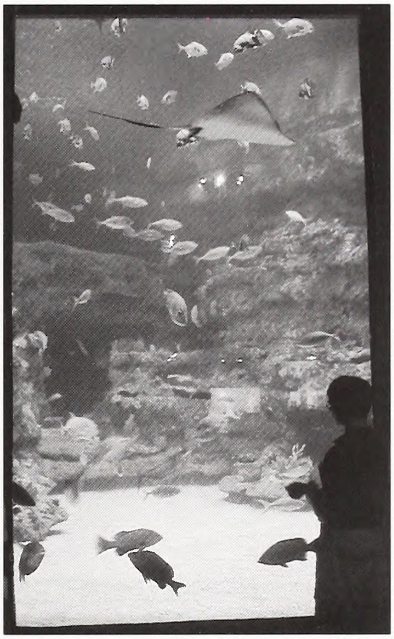
One of the research projects compares observations from the submersible to the catches reported by a commercial fishing boat, the *Amy Marie*, working with the team in The Steeples area.

"Indeed, we saw many of the same top predators, including yellowmouth grouper, red snapper, vermilion snapper, scamp and porgy, that typically wind up in the local fish markets. But through the eye of the submersible, we saw much more," Sulak says of the dives where 50 or more species were recorded.

Comparison of trawl and submersible data is part of a project funded by the N.C. Fishery

Scott D. Taylor

Scott D. Taylor



LEFT TO RIGHT: A workshop helped teachers, from left Heather Miller, Beth Broadhurst and Nancy Williams, all from Greenville, take ocean lessons to the classroom. Tanks at the N.C. Aquarium at Fort Fisher help bring ocean lessons alive.

Resource Grant Program, which encourages partnerships between the commercial fishing and academic communities.

Such individual projects within the overall expedition have specific research goals, but the data and observations often fit into larger policy issues — such as selecting Marine Protected Areas or identifying essential fish habitats.

FROM SEA TO SCHOOL

While researchers are studying schools of fish, schools full of children eagerly follow research cruises via the Internet.

Paula Keener-Chavis, education coordinator of the NOAA Office of Ocean Exploration, is working with the National Undersea Research Center at the University of North Carolina at Wilmington, the N.C. Aquarium at Fort Fisher, North Carolina Sea Grant and other agencies to help teachers take undersea lessons into more classrooms.

During Islands in the Stream, educators gathered at UNC-W to learn more about the expedition and even chat with the scientists onboard, thanks to satellite phone technology.

"This is an exciting new initiative for marine education," says Lundie Spence, former North Carolina Sea Grant marine educator, who now directs the Southeast Center for Ocean Science Education Excellence. (See related story, page 4.)

"The Ocean Exploration missions have a mandate to spend 10 percent of funding on education, so this is a significant opportunity for North Carolina schools to get new, lively yet relevant content and materials," adds Andrew Shepard, NURC associate director.

Flo Gullickson, a Guilford County high school teacher, says lessons such as "All That Glitters" — which explains bioluminescence — fit her courses. "It is very impressive to see how visible light enters the deep ocean and why animals have certain colorations."

Students in her classroom begin to understand the underwater experience that takes the breath away from even a veteran marine educator.

Baird saw the light effects on her first dive in the sub — down 2,900 feet at The Point.

"We saw just a few fish, but there were lots of amazing shrimp with long flowing antennae. The bioluminescence was incredible. It was like being in a glowing snowstorm," she says.

"I love being at sea," she adds.

Join the World of Ocean Exploration

So, you want to be an Ocean Explorer? Check out *http://oceanexplorer.noaa.gov/* to read logs of past voyages. Expeditions this year include:

- The "old growth forests" of the Oculina Banks Marine Protected Area off Florida will be the site for an expedition starting in late April that includes a NASA ship normally used to recover space shuttle rockets.
- The recovery of artifacts from the *USS Monitor* continues off the North Carolina coast this summer.
- Seafloor seepage of oil and gas — and the reaction of deep-sea communities — will be explored this summer in the Gulf of Mexico.

For details on the 2002 Islands in the Stream mission, you can also go to *www.naturalsciences.org* and follow links to the education pages with daily logs, curriculum materials, and students' e-mail questions and the researchers' responses.

The National Undersea Research Center at UNC-Wilmington enables teachers and students to follow missions in the *Aquarius* undersea lab off Florida. Go to *www.uncw.edu/nurc*.

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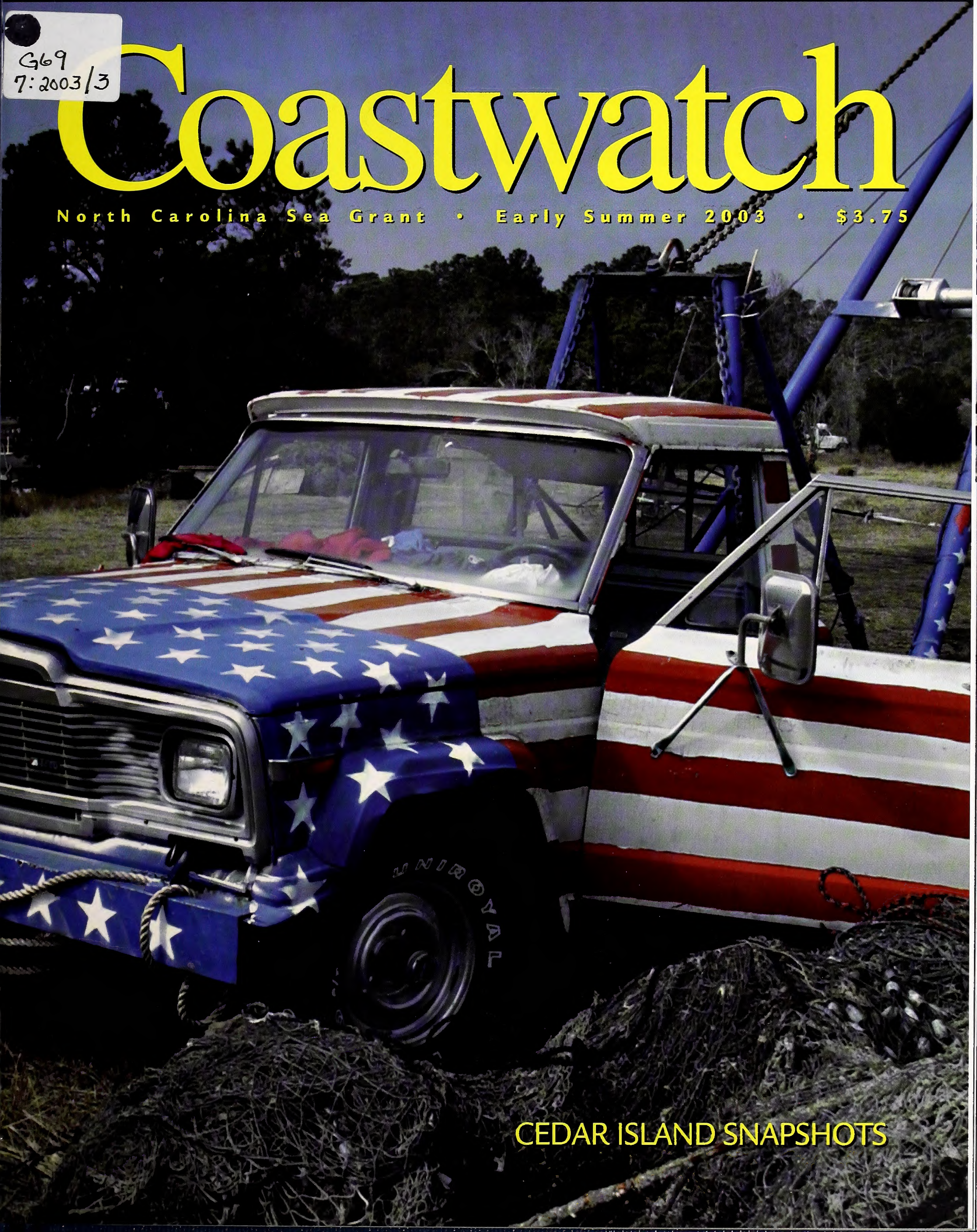


CEDAR ISLAND SNAPSHOTS

FROM THE EDITOR

Honorable Neighbors

Herman Lankford

As summer approaches and the school year winds down, students are participating in countless honors assemblies across our state. Our congratulations go out to all those applauded by teachers and peers.

Congratulations also go out to winners in the annual Governor's Conservation Achievement Awards, sponsored by the N.C. Wildlife Federation and the National Wildlife Federation, through an agreement with the governor's office.

The following partial list of winners starts with a teen who sets an example for us all.

- ***Youth Conservationist:*** Christopher Dimond of Oriental already has a varied resume, including grant writing, trail building and curriculum developing. An Eagle Scout and 4-H honoree, he leads projects such as improving habitat for pitcher plants in Croatan National Forest.
- ***Wildlife Conservationist:*** Jerry Holloman of Williamston recently retired as the superintendent of the Roanoke River National Wildlife Refuge. This 40-year veteran of the refuge system in North Carolina was an early advocate of "ecosystem management."
- ***Air Conservationist:*** The U.S. Coast Guard's Aircraft Repair and Supply Center in Elizabeth City is recognized for an 82 percent reduction in hazardous waste and a 90 percent reduction in hazardous air pollutants. The facility repairs all of the Coast Guard's aviation fleet.
- ***Water Conservationist:*** As a scientist with Environmental Defense, Douglas Rader has focused his attention on coastal watersheds and marine fish habitats. His work has included fisheries reform topics and the emerging role of marine protected areas.
- ***Conservation Communicator:*** Readers of *Wildlife in North Carolina* enjoy the natural history illustrations of David Williams of Raleigh. His topics stretch across the state, from hardy dune plants to delicate mountain flowers.
- ***Marine Enforcement Officer:*** Chris Bennett of Morehead City is honored for both his field knowledge and his work on rules and policy committees. New officers benefit from his broad experience, as he also serves as training officer for the N.C. Marine Patrol.
- ***Conservation Organization:*** The Triangle Land Conservancy reflects how land conservation efforts can improve water quality not only in the Triangle, but also throughout watersheds stretching to the coast.
- ***Business Conservationist:*** Owner of Autobell Car Wash, Inc., Chuck Howard of Charlotte is a leader in water recycling efforts, treating 100 percent of the water used by his sites and recycling 80 percent of the treated water.
- ***Environmental Educators:*** Ricky Hayes and Jamie Ragan of the Wilson County Soil and Water Conservation District have an "infectious passion" for the environment, shown through a puppet show, mascot, and presentations to schools and museums.
- ***Legislator:*** Martin Nesbitt of Asheville was cited for his work on the "Clean Smokestacks Bill," which recognizes the broad effects of air pollution, and other legislative efforts, including those on behalf of fishing families.
- ***North Carolina Conservation Hall of Fame Inductee:*** Former editor of *Wildlife in North Carolina*, Duane Raver is known across the nation and the world for wildlife art that brings out subtle and dramatic aspects of so many creatures. His illustrations are featured in our *Shark Sense* brochure.

For a complete list of the winners, or for details on the next nomination deadline, contact the N.C. Wildlife Federation at 800/264-NCWF.

During your next visit to the coast, honor these folks by taking time to identify the birds in the surf or marsh, by picking up trash, or by sharing your awe of the wonders of nature.

Katie Mosher, Managing Editor

IN THIS ISSUE

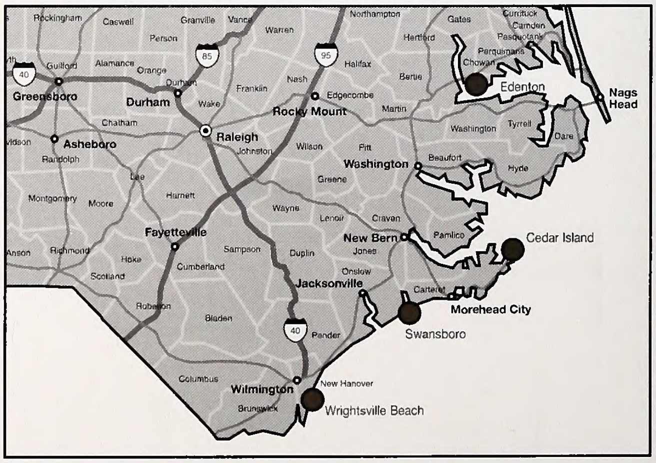
Contributing Writers:

Gianna Cohn □ Ann Green □ Cynthia Henderson
Katie Mosher □ Julie Ann Powers □ Pam Smith

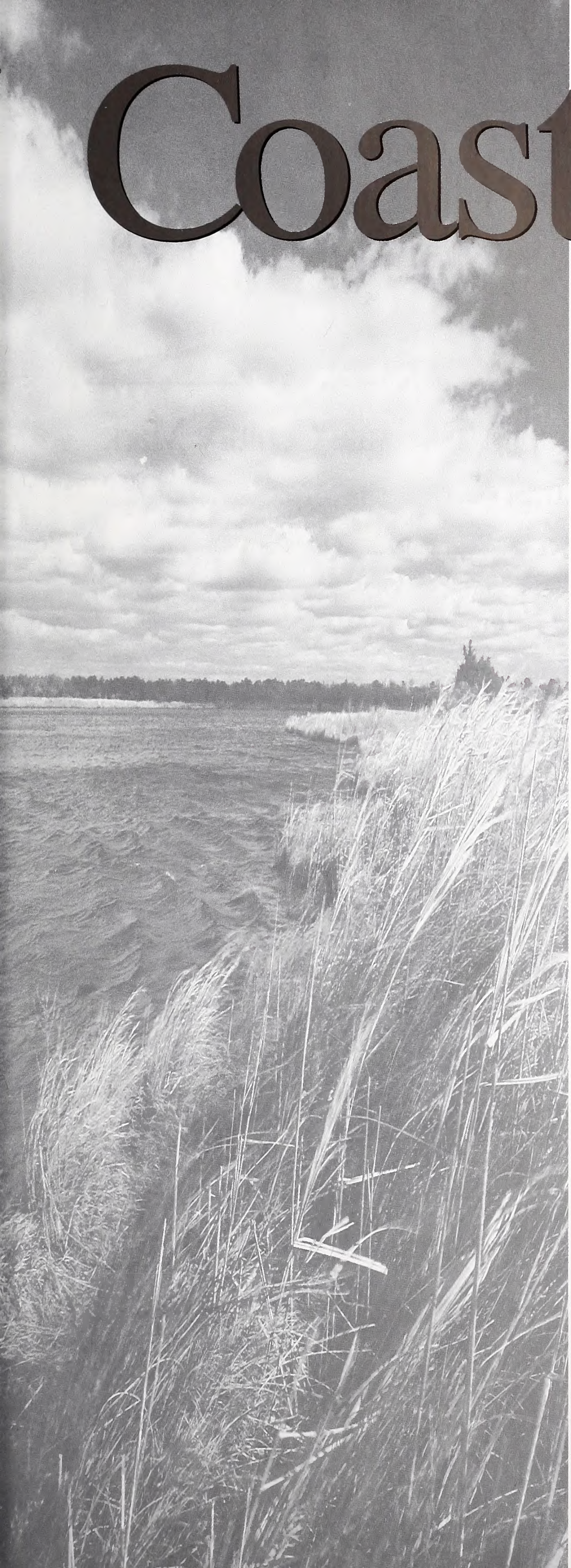
Contributing Photographers:

Barabra Doll □ Lucille Harrell □ Owen Hassell
Bill Hunt □ Ulrich Mack □ Mike Marsh
Pam Smith □ Scott D. Taylor □ Tracy Skrabal

North Carolina's diverse coast offers countless interesting subjects. The large dots on the locator map indicate story settings in this issue — including Edenton, Cedar Island and Wrightsville Beach.



Coastwatch



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Coastwatch

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The North Carolina Sea Grant College Program is a federal/state program that promotes the wise use of our coastal and marine resources through research, extension and education. It joined the National Sea Grant College Network in 1970 as an institutional program. Six years later, it was designated a Sea Grant College. Today, North Carolina Sea Grant supports several research projects, a 15-member extension program and a communications staff. Ron Hodson is director. The program is funded by the U.S. Department of Commerce's National Oceanic and Atmospheric Administration and the state through the University of North Carolina. *Coastwatch* (ISSN 1068-784X) is published six times a year by the North Carolina Sea Grant College Program, North Carolina State University, Box 8605, Raleigh, North Carolina 27695-8605. Telephone: 919/515-2454. Fax: 919/515-7095. Subscriptions are $15. E-mail: katie_mosher@ncsu.edu World Wide Web address: *http://www.ncsu.edu/seagrant* Periodical Postage paid at Raleigh, N.C.

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Front cover photo of a Cedar Island "boom truck" and table of contents photo of the White Oak River near Stella by Scott D. Taylor. Printed on recycled paper.

Photos courtesy of U.S. Fish & Wildlife Service

Wildlife Refuges Celebrate Century Mark

It all began in 1903 when President Theodore Roosevelt set aside the five-acre Pelican Island off the Florida coast for the protection of pelicans and other species from market hunters.

From that humble beginning arose America's National Wildlife Refuge System, which now encompasses more than 95 million acres on more than 540 refuges and thousands of waterfowl production areas.

This year, the U.S. Fish & Wildlife Service is celebrating the Centennial Anniversary of the National Wildlife Refuge.

Twelve refuges are partially or completely within North Carolina's boundaries. The refuges include Cedar Island National Wildlife Refuge at the tip of Carteret County and Mackay Island National Wildlife Refuge at Knotts Island on the north side of Currituck Sound.

The state's first refuge was Swan Quarter, established in 1932. It includes areas frequented by migratory waterfowl and other marsh birds.

"Refuges in North Carolina provide important habitat for migratory waterfowl, songbirds, shorebirds and numerous endangered species, as well as a wonderful outdoor setting for people of all ages to enjoy and learn about the natural world," says Bill Grabill, refuge supervisor for the U.S. Fish & Wildlife Service in North Carolina, South Carolina, Georgia and the Caribbean.

To find about more about North Carolina's national wildlife refuges, visit: *http://refuges.fws.gov* and follow the links.

To learn more about the Cedar Island Wildlife Refuge, turn to page 6. – A.G.

'What's Cookin' In Cape Fear'

During the 1800s, Wilmington's wharves were crowded with a variety of goods — from barrels of sugar to citrus.

Experience the development of the region's food from 1800 to 1900 in a new exhibit at the Cape Fear Museum in Wilmington. The "What's Cookin' in Cape Fear" exhibit runs through Nov. 20.

The interactive exhibit focuses on the role of the Cape Fear River and Wilmington's port. Visitors also can track the import and export of food over time — from locally grown to exotic international foods — and learn about changing preservation technologies.

For more information, visit the Web: *www.capefearmuseum.com* – A.G.

In the Next Issue of *Coastwatch*

Pam Smith shares a "call to action" for anyone who has relished a fresh-caught sea bass dinner or reveled at a Down East oyster roast. Learn how to help shape the emerging Coastal Habitat Protection Plans – a coordinated state effort to preserve the productivity of all fisheries. And Cynthia Henderson shares the latest research results regarding blue crabs, the state's leading commercial fishery.

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RALEIGH

Sea Grant Leaders Now Ambassadors

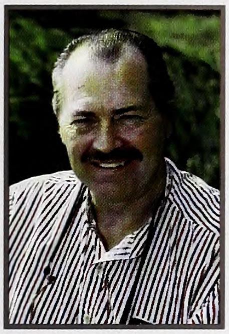
North Carolina Sea Grant aquaculture leaders are among 10 Ambassadors of Agriculture named by N.C. Agriculture Commissioner Meg Scott Phipps.

Ronald G. Hodson, Sea Grant director, and Skip Kemp, Sea Grant mariculture and seafood marketing specialist, were honored for their "active participation and ongoing support of the aquaculture industry in North Carolina."

Hodson is recognized internationally for developing protocols for the successful production of hybrid striped bass.

Kemp is known for working to improve methods to raise clams and oysters in North Carolina.

Phipps also honored Harry Daniels and Tom Losordo, North Carolina State University faculty long associated with Sea Grant's aquaculture outreach initiatives.



Ron Hodson

Skip Kemp

Other newly named "ambassadors" include Greg Barnes and George Sullivan of the N.C. Farm Bureau; Frank Pore, Michael Twiddy and Lisa Ruckdeschel of the N.C. Small Business Technology Development Center; and Greg Walker of the N.C. Association of Soil and Water Conservation Districts.

"The public-private-university partnerships among these individuals and with the North Carolina Department of Agriculture and Consumer Services have helped make North Carolina aquaculture successful," Phipps said in a press release.

The awards were given during the annual N.C. Aquaculture Development Conference.

– P.S.

Hurricane Expos Set

In each of the past five years, the East Coast has had an average of 12 hurricanes, but none has rattled North Carolina like Hurricane Floyd in 1999.

To tackle the looming hurricane season, two Hurricane Expos are being planned. With our hurricane season beginning June 1, the events couldn't come at a better time.

- The WECT-TV 6 Hurricane Expo 2003 will be in Wilmington on May 31. Exhibits will be open from noon to 5 p.m. at the Coastline Convention Center.
- On June 7, Craven County's third annual Hurricane Expo will join forces with Neuse River Day in downtown New Bern and Union Point Park.

The New Bern expo will showcase a variety of organizations, such as the National Weather Service, as well as commercial businesses that promote disaster preparedness throughout eastern North Carolina.

Participants will learn how to prepare for a hurricane in a mobile home or in a boat, how to correctly use a generator and how to purify water, just in case.

Sponsors include Lowe's, the Coastal Carolina Chapter of the American Red Cross, WCTI-TV and the *Sun Journal*.

Neuse River Day, sponsored by the Neuse River Foundation, will occur at the same time as the expo. Events planned will include the annual raft race, a dunking booth and a petting zoo.

For more information about the New Bern Hurricane Expo, call 252/637-3405 or the Neuse River Day, call 252/637-7972.

For more information about the Wilmington Hurricane Expo, call 910/791-8070.

– G.C.

Photos by Owen Hassell

Jennette's Pier Tradition Continues

Jennette's Pier at Nags Head is getting a facelift. The site, recently purchased by the N.C. Aquarium Society for $4.55 million, is being renovated for use as a fishing pier and educational facility.

"We are trying to bring the pier back to its former glory," says manager Mike Remige. "The pier was built in 1939 and is the oldest pier on the Outer Banks. We want to maintain the pier as a family tradition."

In April, the pier reopened for fishing. However, the formal dedication will be held May 24. After the morning ribbon cutting, anyone can walk on the pier that day for no charge.

"By the end of May, we hope to have the educational facility open," says Remige. "We will have a classroom where we will have programs for all ages."

Future improvements include a lunch counter with grill and an arcade with games. For more information, call 252/441-6421.

– A.G.

Beach Bound? Be Prepared

Going to the coast to enjoy sun, surf and sand? Along with your sunscreen and sunglasses, pack these Sea Grant publications:

- *Seashells of North Carolina* (UNC-SG-97-03, $12): Beachcombing is all the more enjoyable when you can identify unusual shells along the beach.
- *Shark Sense: Atlantic and Gulf Regions* (UNC-SG-02-07, single copies free): Experts evaluate risks and offer tips to prevent shark attacks. Sharks common to our waters are illustrated.
- *Rip Currents: Don't Panic* (UNC-SG-00-01, single copies free): Rip currents can pull even experienced swimmers away from shore. Learn telltale signs – and what to do if you are caught in one.
- *Shifting Shorelines: A Pictorial Atlas of North Carolina Inlets* (UNC-SG-99-04, $15): Dramatic photos and narratives provide the history of the 22 tidal inlets scattered along the North Carolina coast.

To order any of these publications, call Sea Grant at 919/515-9101. Or, send an e-mail to *harriss@unity.ncsu.edu*.

– P.S.

Photos by Ulrich Mack

Core Sound Museum Hosts Homecoming

When German photographer Ulrich Mack trekked Harkers Island during the 1980s, he found the island people strikingly similar to his island people in Germany.

So, he photographed numerous residents for a photo essay that compares this community to Pellworm Island off Germany's coast.

Mack's 144 photographs "Island People" will be on display at the new Core Sound Waterfowl Museum on Harkers Island from May 23 through July 6.

The exhibit is part of the museum's Memorial Day celebration May 23 to 25. The celebration highlights the museum's new building at the end of Harkers Island.

Participants also can view other exhibits, including the Core Sound collection of decoys and the *Jean Dale*, a Harkers Island-style boat designed by native Brady Lewis. In addition, there will be outdoor events for children, local crafts and carvers, music and an auction.

On Sunday, May 25, the public is invited to attend a homecoming, Down East dinner on the grounds and blessing of the new building.

For more information, call 252/728-1500 or click on: *www.coresound.com.*

– A.G.

East Carteret Wins Blue Heron Bowl

East Carteret High School in Beaufort took top honors in the 2003 Blue Heron Bowl at the University of North Carolina at Wilmington.

The team will represent North Carolina in the 2003 National Ocean Sciences Bowl (NOB) in San Diego.

Other winners were: Myers Park High School, Charlotte, second place; Washington High School, Washington, third place; Raleigh Charter High School, Raleigh, fourth place; and John Holmes High School, Edenton, best sportsmanship.

During the team competition, students answered questions about ocean-related science, technology, history and navigation.

In addition to a trip to the NOB, the first-place winners and coach received a laptop computer and other prizes.

The Blue Heron Bowl is one of 21 regional competitions of the NOB, which is supported by the Consortium for Oceanographic Research and Education.

Sponsors included the University of North Carolina at Wilmington Center for Marine Science, North Carolina Sea Grant and several other organizations.

The 2004 Blue Heron Bowl will be held in Wilmington. For more information, contact Diane Talley, 910/962-2460, or *marinequest @uncw.edu*.

– A.G.

Lighthouse Living

Photo courtesy Marilyn Austin Meads

Julian Austin, Jr. (left) and sister Marilyn in front of the double keepers quarters at the Bodie Island Lighthouse.

Have you ever sat around with friends over coffee reminiscing about where you grew up? The stories you remember made you who you are today. They are windows into your past.

Meet the children of two Bodie Island lighthouse keepers in a new video as they recall "Growing Up At the Lighthouse," from the early 1920s to 1940s.

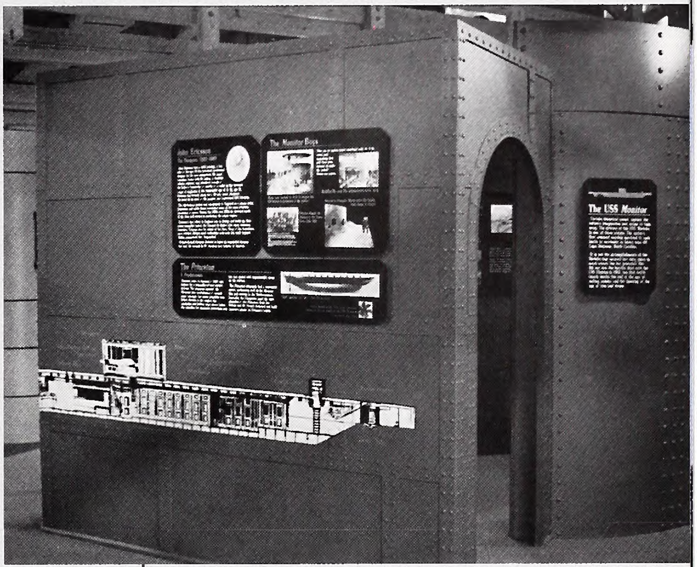
The 45-minute video was produced with the cooperation of Bruce and Cheryl Roberts, The Outer Banks Lighthouse Society and Coastal Production Company. The video is narrated by Outer Banks native Ken Mann.

Growing up on the Outer Banks was sometimes lonely, but the children of Vernon Gaskill and Julian Austin learned lessons of life just the same. In their Outer Banks brogue, they recall a time when there were no paved roads and travel was an adventure, when digging in the sand to find turtle eggs would help pass the time.

Bodie Island Lighthouse also is set to receive funding from Home & Garden Television (HGTV) and The National Trust for Historic Preservation for the restoration and preservation of the historic site, guaranteeing that the stories of the Gaskills and the Austins live on.

The video may be purchased at the Bodie Island Lighthouse Visitors Center. Or, send a check for $29.20 (including tax & shipping) to Coastal Production Company, P.O. Box 431, Wanchese, NC 27981 (252/473-3024). Visit the Outer Banks Lighthouse Society online at: *www.outer-banks.com/lighthouse-society*.

– G.C.



Museum Highlights *Monitor* Exhibit

Thirty years ago, Duke University Marine Laboratory scientists located the wreck of the *USS Monitor* in waters off Cape Hatteras.

To commemorate the 30th anniversary of the discovery of the famed Civil War ironclad ship, the N.C. Maritime Museum in Beaufort is showcasing a *Monitor* exhibit through August.

The exhibit highlights the work of the late John G. Newton, expedition organizer, as well as recent recovery efforts.

To get a glimpse of the *Monitor*'s design and construction, visitors can walk through a turret-like facade that has a panel of text and photographs.

A scale model shows the ship and its only battle with the *CSS Merrimac,* also known as the *CSS Virginia*. The gun turret, which was recovered from the ocean floor, enabled the *Monitor* to fire in any direction, regardless of its heading.

For more information, visit the Web: *www.ah.dcr.state.nc.us/sections/maritime* and click on calendar of events.

– A.G.

NC 8873 BZ

CEDAR ISLAND:
Laid-Back Lifestyle Still Prevails

By Ann Green
Photos by Scott D. Taylor

WELCOME
To
CEDAR ISLAND
Gateway To The Outer Banks

FAR LEFT:
Marshall Daniels' boat Libby *takes a rest.*

LEFT TO RIGHT:
The Cedar Island Harbor is a popular gathering spot for fishers.
A crabber heads out to set his pots.
A sign on N.C. 12 welcomes visitors.

It's a slow day Down East as a yellow lab roams along the Cedar Island Harbor pier.

Nearby, a young man listens to a Willie Nelson song while relaxing on a well-worn gray sofa inside an open shelter facing the harbor.

As soon as a white skiff pulls in, everyone rushes to see the catch of the day.

"It's all local people. It is like a big old family," says Joe Taylor, who owns one of the piers. "No one squabbles. We use each other's docks."

There have been few changes at the harbor over the years. "It's rustic. The place has not been fancied up," says Taylor. "There is no concrete here. It is a do-it-yourself-place. People build their own piers."

Not far from the harbor, Bradley Styron operates Quality Seafood out of a concrete building adorned with an American flag. His crew fishes year-round. On this day, men are icing down a load of fresh shrimp.

"I come from a fishing family," says Styron, who serves on the N.C. Marine Fisheries Commission. "Everybody was a fisherman. Fishing is our heritage."

In Cedar Island, 40 miles east of Beaufort, fishing still dominates most people's lives.

Along the main road, some homes have gardens that are fenced off with fishing nets. Others have fishing boats parked in the front yard. Brightly painted "boom trucks" haul fishing gear.

The community's only variety store, Island Choice, is packed wall-to-wall with fishing gear, hardware and groceries.

"Ninety percent of the people on Cedar Island still fish for a living," says Cedar Island native Jerry Gaskill, director of the N.C. Department of Transportation's Ferry Division. "The rest of the people work for the ferry division or go into Beaufort or Morehead City to work."

The ferry dock is the only busy spot. During the summer season, cars are lined up bumper to bumper to catch the ferry to Ocracoke.

It is a "unique community" because of the Cedar Island National Wildlife Refuge that spreads over more than 14,000 acres, says Woody Hancock, who raises horses. "There is no room for growth. It's as laid back as you can get."

Natives still retain the famed "Hoi Toide" accent, a remnant of Old English that was once spoken in colonial Carolina.

One of their favorite expressions is "right slick cam" when the water is as smooth as glass, according to author Jean Day, who lived on Cedar Island during the 1950s.

ISOLATED COMMUNITY

To get to Cedar Island, head east from Beaufort along U.S. 70 to N.C. 12. Along the way, marshes stretch for miles along the shoulders. The only sign of life is people coming in and out of convenience stores and homes in the tiny communities of Bettie, Otway, Smyrna, Williston, Stacy, Sea Level and Atlantic.

After passing over the Monroe Gaskill Bridge, a sign says: "Welcome to Cedar Island, Gateway to the Outer Banks."

Along the road, fingers of emerald green

Continued

CLOSED AREA
NO SHRIMPING
N.C. MARINE FISHERIES

salt marsh and tea-colored water create a checkered pattern. Nearby, a laughing gull poses on the post of a boat dock.

The wide expanse of marsh makes up the southern end of the Cedar Island National Wildlife Refuge that stretches across 11,000 acres of irregularly flooded brackish marsh and 3,480 acres of pocosin and woodland habitat.

"Cedar Island is a world-class marsh," says East Carolina University geologist Stan Riggs, author of the *Soundfront Series: Shoreline Erosion in North Carolina's Estuaries.* "It goes on forever and ever. It is a unique type of platform marsh. It is pretty awesome."

Riggs says that brackish marshes like Cedar Island "are among the most productive habitats in the world."

FAR LEFT, TOP:
Cedar Island National Wildlife Refuge has vast marshland.
FAR LEFT, BOTTOM:
The waters in the refuge are abundant marine habitats.

LEFT TO RIGHT:
Don Temple leads the Cedar Island refuge. Henry "Farmer" Styron and Marshall Daniels cook shrimp at Farmer's garage. Jerry Gaskill and Bradley Styron await a box of shad at Quality Seafood.
Troy Goodwin mends a net.

"Wind- and storm-tide flooding carry nutrients into the marsh and sweep dead plant material out into the estuaries and adjacent ocean-shelf waters," wrote Riggs in *Exploring North Carolina's Natural Areas*, edited by Dick Frankenberg. "This organic detritus forms the basis for many food chains for marine organisms. Brackish marshes are essential for maintaining many different populations of estuarine and marine fish and shellfish."

Before touring the refuge, manager Don Temple points out the stretch called "John Day's Ditch" that runs through the marsh. On this day, a lone man is fishing in a ditch as a kingfisher flies over.

Legend says that John Day dug the ditch to protect his cows from crossing into another landowner's property, says Temple.

"The ditching changes the hydrology of the marsh," says Temple. "The road's ditches introduce changes in the marsh and vegetation near the ditch."

To see the refuge, Temple gives a driving tour in a Ford Expedition along an open patch of low grass. A thick forest of red cedar, pines and underbrush line the side of the path that is mowed only a couple of times each year.

"This area is a low wetland with a stream going through it," says Temple.

Farther back, live oaks drape the bumpy road. Wild huckleberry and blueberry bushes and a deer stand fill in the landscape.

"If we were on a barrier island, it would be called a 'maritime forest,' " says Temple.

The path stretches 2.5 miles to a tidal creek. There, mosquitoes create an almost black coat on the side of the car in the fall and summer. The emerald green creek is covered with black needlerush and other flora.

Temple says the best time to visit is in December or January when the mosquitoes are not buzzing as much.

DIVERSE ANIMALS, BIRDS

A variety of wildlife calls the refuge home, including black bear, deer, otter and marsh rabbits, says Temple. More than 270 species of birds, including marsh wrens, seaside sparrows, northern harriers and ospreys, have been observed on the refuge.

One of the most unusual birds is the black rail. "Black rails are a secretive bird and meander through the marsh floor," says Temple. "I have been here for 14 years and have never seen one. You only see them if they are flushed out by a fire or predator. During floods, the rails get up on higher vegetation."

To see the rest of the marsh, turn on Lola Road, where there is a thicket of longleaf pines.

"Longleaf pines are being considered by the Nature Conservancy to be globally threatened," says Temple. "There used to be 10 million acres of longleaf pine in the Southern Coastal Plain. Now there is only a small percent. Longleaf pines need fire to regenerate."

The wildlife refuge has a prescribed burn program that promotes new growth and plant diversity.

"We burn parts of the refuge almost every year," says Temple. "We average burning 3,000 to 5,000 acres of marsh and upland a year. Many of our plants are fire dependent."

During fall and winter, thousands of migratory waterfowl use Core Sound and other estuarine waters.

"The best way to see this part of the refuge is by boat or kayak," says Temple. "In some years, this creek will get 4,000 to 5,000 redhead ducks in January or February."

At the end of Lola Road, the refuge stretches to Core Sound, where there are two boat docks.

Head back down Lola Road, and you notice an old Navy radar station used during the Cuban Missile Crisis of the 1960s.

Farther down, large cedars shade the island's oldest church — the white-framed Pilgrim Rest Free Will Baptist Church, where they hold the Day family reunion each year.

"My son, Robert Day, always sings 'Oysters in Heaven' and gets a standing ovation," says Jean Day. "There is always a rush for the seafood platters. Those men and women on Cedar Island are some of the best cooks in the world."

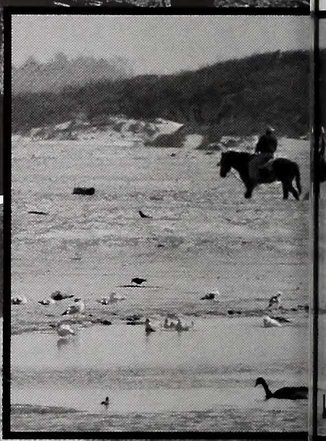
Turn onto N.C. 12 to get to the main part of the Cedar Island community that brings memories of a slower, kinder time when folks got together more often. The area is unincorporated and has no gas stations.

SPECIAL RETREAT

One of the community's favorite gathering spots is Jerry Gaskill's "Little House," a tiny cream-colored wooden building next to his main home.

Continued

ISLAND'S CHOICE
VARIETY STORE
DORAL
DORAL
2.29
OPEN
1.849
TANNING
CAMEL
ATM
$24.19
ICE
ICE



"We love it here," says Gaskill. "Every weekend, we have lunch here with a lot of family. Last night, I made flounder stew for 14 people."

The retreat, which has a kitchen, eating area and grill, is decorated with Down East memorabilia, including a banner: "Save the Commercial Fishermen," an oyster tong, and a collection of decoys from the Hog Island Hunting Club that is now used by the Young Men's Christian Association.

"These decoys were used for goose hunting during the late '30s and '40s," says Gaskill. "Both my father and brother worked at the hunting club."

Outside, you can swing in a hammock, sit at a picnic table, or walk to the edge of the rocky shoreline on Cedar Island Bay.

Because of shoreline erosion, Gaskill says that water now covers an old sweet potato field and the site of an elementary school.

The front yard also reflects Gaskill's Down East heritage. A pelican adorns his mailbox. Both a North Carolina flag and American flag flap in the sea breeze. Two tombstones enscribed with "Gaskill" stand near the fence.

Gaskill says that his son found the tombstones while flounder fishing on nearby Hog Island across the bay from Cedar Island.

"I tell people that I don't have to buy a footstone," he says with a chuckle.

After leaving Gaskill's retreat, you pass several empty buildings and the Cedar Island United Methodist Church.

Before reaching the ferry building, visitors and natives often stop at the Driftwood Motel and Restaurant for clam chowder or other Down East seafood. The restaurant is decorated nautical style with mounted fish, surfer art and a ship's steering wheel on the wall.

At the ferry harbor, huge rock walls surround the docks that jut into Pamlico Sound. On the right is an extensive sandy beach and Cedar Island Stables, where you can rent a horse to ride. While riding, you might catch a glimpse of the island's wild horses that are small in size and descended from the Shackleford Banks horses.

"We are trying to rebuild the wild herd," says Hancock, who manages the horses. "During the January roundup, we adopted five mares from Shackleford Banks."

FAR LEFT, TOP: The back of Island's Choice faces North Bay. FAR LEFT, BOTTOM: Crab pots are a familiar sight in Cedar Island waters.

LEFT TO RIGHT: Many people fish for a living on Cedar Island. During the summer, traffic is heavy at the ferry landing. Visitors enjoy riding horses on the beach.

ISLAND'S HISTORY

Local legend has it that Cedar Island, instead of Roanoke Island, has a connection to the famed Lost Colony.

The island's early settlers were fishing and whaling folks as well as farmers. From the Civil War until 1918, when the selling of many waterfowl became illegal, ducks and geese were hunted and sold. After that, duck and goose hunting became a recreational activity.

Because of the remoteness of the island, Cedar Island lagged behind in mail service, modern communications and paved roads.

The first post office was established in 1905 at Lola. There was no paved road until 1952. Telephone service wasn't begun until 1959.

"When I was a young boy in the 1950s, my grandfather delivered the mail in horse and cart," says Gaskill.

Because of the island's small population, now around 300, everybody knew everybody, according to Gaskill. "We played ball in the middle of the dirt road," he says. "If a car came along, they would stop for us. People got along better then. They had gardens, sold fish and were self-contained."

Many of Gaskill's contemporaries left the island after graduation.

"When I finished high school, I went to work on a dredge boat," says Styron. "I came back because I wanted to be home. I began fishing because there was nothing else to do."

In the 1960s, many changes came to the island. In 1963, the ferry terminal was built at the end of Cedar Island. In 1964, the U.S. Fish & Wildlife Service began acquiring acres for the wildlife refuge.

In that same year, ferry service to Ocracoke began and put the tiny community on the map.

While on an unspoiled tract of prairie in Iowa, Day met some sightseers who had been on the ferry. "Imagine our surprise when we discovered that they had recently come down the North Carolina Outer Banks and crossed over from Ocracoke to Cedar Island on the ferry and were very enthusiastic about the fisher-folk charm of Cedar Island," writes Jean Day in *Cedar Island Fisher Folk.* "When we lived there in the '50s, it was the jumping off place or the end of the road."

With the arrival of the ferry, more newcomers began moving to the island.

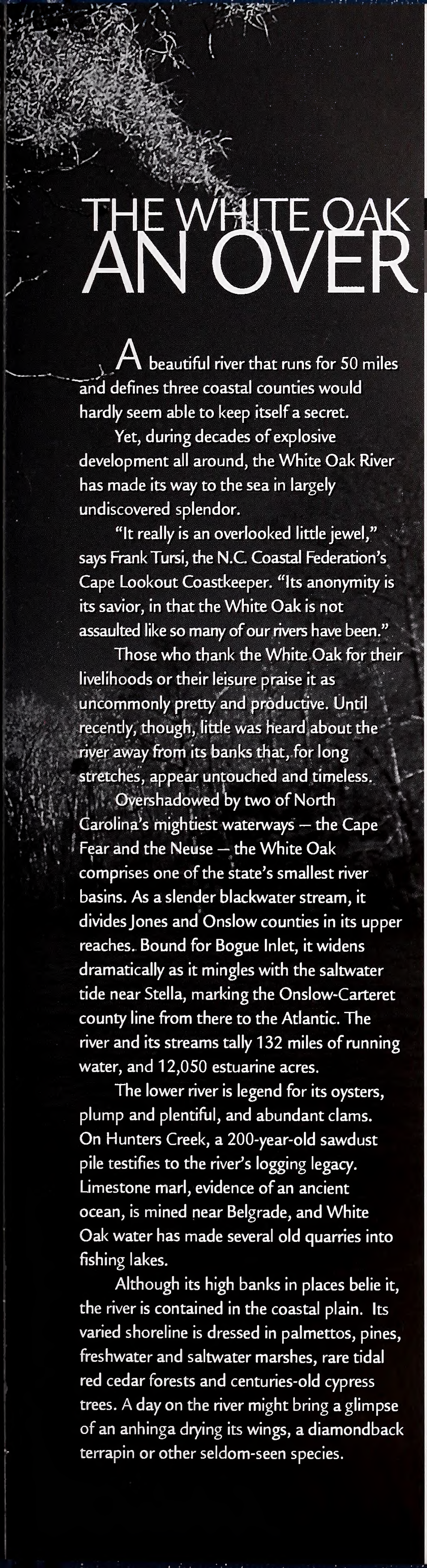
"A lot of people move here, stay awhile and then leave because they are unhappy," says Ellen Goodwin, manager of the Cedar Island Ferry. "Whatever you want, it takes an hour or so to get to."

But the natives always come back.

"I have lived at a lot of different places," says Day, who now lives in Newport. "But Cedar Island is the only place I come back to. It just gets in your blood." ◘

For more information on the Cedar Island National Wildlife Refuge, call 252/926-4021 or visit the Web: http://refuges.fws.gov. *For information about the N.C. Department of Transportation Ferry System visit:* www.ncferry.org *or call 800-BY-FERRY.*

The often-overlooked White Oak River offers striking shorelines, such as this one north of Haywood's Landing.



THE WHITE OAK RIVER: AN OVERLOOKED JEWEL

BY JULIE ANN POWERS
PHOTOS BY
SCOTT D. TAYLOR

A beautiful river that runs for 50 miles and defines three coastal counties would hardly seem able to keep itself a secret.

Yet, during decades of explosive development all around, the White Oak River has made its way to the sea in largely undiscovered splendor.

"It really is an overlooked little jewel," says Frank Tursi, the N.C. Coastal Federation's Cape Lookout Coastkeeper. "Its anonymity is its savior, in that the White Oak is not assaulted like so many of our rivers have been."

Those who thank the White Oak for their livelihoods or their leisure praise it as uncommonly pretty and productive. Until recently, though, little was heard about the river away from its banks that, for long stretches, appear untouched and timeless.

Overshadowed by two of North Carolina's mightiest waterways — the Cape Fear and the Neuse — the White Oak comprises one of the state's smallest river basins. As a slender blackwater stream, it divides Jones and Onslow counties in its upper reaches. Bound for Bogue Inlet, it widens dramatically as it mingles with the saltwater tide near Stella, marking the Onslow-Carteret county line from there to the Atlantic. The river and its streams tally 132 miles of running water, and 12,050 estuarine acres.

The lower river is legend for its oysters, plump and plentiful, and abundant clams. On Hunters Creek, a 200-year-old sawdust pile testifies to the river's logging legacy. Limestone marl, evidence of an ancient ocean, is mined near Belgrade, and White Oak water has made several old quarries into fishing lakes.

Although its high banks in places belie it, the river is contained in the coastal plain. Its varied shoreline is dressed in palmettos, pines, freshwater and saltwater marshes, rare tidal red cedar forests and centuries-old cypress trees. A day on the river might bring a glimpse of an anhinga drying its wings, a diamondback terrapin or other seldom-seen species.

THE SECRET IS OUT

With much to offer a world clamoring for waterfront property, word is getting out about the White Oak.

"As these other places start to develop, attention turns more and more to what once were out-of-the-way places," says Tursi. "The White Oak is certainly a target and needs to be protected."

In its basin, country churches still stand sentinel over a rural landscape. Small farms offer eggs for sale with hand-lettered placards beside quiet roads. But new houses are appearing among the pretty pastures where goats graze, and slick signs announce future subdivisions. Though Swansboro remains a small town at 1,426 people, the river's only major population center grew by 46 percent between 1980 and 2000.

The recent widening of N.C. 24 around Swansboro is the biggest portent to possible change. The highway itself affects the river's flow and water quality. It also could usher more people and pavement to many undeveloped acres, should public sewer and water follow.

"If not done carefully, it could be bad news," says Tursi.

What presently makes the White Oak remarkable for so much of its length also ensures some preservation. Public woodlands cover a lot of its basin. Its headwaters rise from a pocosin in the hush of Hofmann Forest, a 78,000-acre demonstration forest used by North Carolina State University's College of Natural Resources. Croatan National Forest occupies 161,000 acres to its east. A state duck impoundment and 770 acres between Swansboro and Stella, purchased by the Coastal Federation, also preclude development.

Though surrounded by trees, an oak is not the river's namesake. According to old maps, White Oak evolved from "Weetock" or "Weitock," the name of an Indian tribe.

Using the same propulsion as early Native Americans, canoeists and kayakers can paddle canopied streams, mysterious swamps and marshes or vast saltwater expanses — all within a relatively few miles. Whatever waters they favor, paddlers agree the White Oak is enchanting.

"It's one of the prettiest rivers I've canoed," says Elmer Eddy, who has canoed many rivers in his 83 years. "It's a unique and different river."

Thanks to Eddy, known as the "White Oak River Trash Man," the river is unblemished by beer cans and other rubbish. Eddy led the Stewards of the White Oak River Basin in a two-year effort to clean up White Oak waters, and pronounced the river litter-free last fall.

Since he moved to Swansboro from Raleigh three years ago, Eddy has paddled every navigable mile of the White Oak and the streams that feed it. His expedition to the headwaters last year found enormous cypress trees, up to 25 feet around, that have thrived in apparent secrecy for centuries.

"They are a sight to behold," he says. "One of them, you can stand right inside it."

Any day on his beloved White Oak brings wonders, he says — deer grazing, herons wading, alligators slumbering. He recalls a magnificent cypress, made more so by the birds adorning it.

"The whole tree was covered with white egrets. It was a beautiful sight," he says.

POLLUTION PRESSURES

Despite its wilderness ambience, built-in protections and a growing army of defenders on several fronts, the river has long been besieged by a common plague of a growing population. Storm water runoff contamination has prompted the state to close 3,300 of the 8,500 acres of the White Oak's shellfishing waters.

The culprit is a high level of bacteria found in human and animal waste. Nature has its own devices to manage "fecal coliform." Vegetation and marshes slow the flow of rainwater so sunlight and saltwater can kill the organisms. But cleared and paved surfaces send too much fresh water into estuaries too fast, making for more bacteria in the water than is safe for shellfish consumption.

Continued

TOP: Haywood's Landing offers access to the White Oak River, with its popular padding trails for canoes and kayaks. BOTTOM: Commercial fishing boats at Clyde Phillips' Seafood in Swansboro attest to the river's rich natural resources.

Wayne Mobley, the state Shellfish Sanitation Section chief, grew up on the White Oak. Vessels in the 1970s used to take "boatload after boatload" of choice oysters from the rocks between local landmarks called the Turn Stake and Gator Gap, he recalls.

"People used to oyster there day in and day out," he says. "They were just great oysters."

The rocks have been off-limits to shellfishing for many years, due to high bacteria levels. Last year's drought, bad news for much of the state, was good for the White Oak. The lack of rain kept runoff low enough to allow oyster harvesting in some previously closed areas.

The White Oak's prolific clam beds near the river's mouth have evaded long-term closures. But Mobley worries Hills Bay may soon fall victim to runoff from the widened highway.

The White Oak's woes are not unique. "Anytime you have a shallow coastal river, with increased development, you're going to have problems because you don't have the flushing action," Mobley says. "Everybody wants to move to heaven, and coastal North Carolina is heaven. The more people we have, the more contaminants we have, the more pollutants we have."

Russell Howell, a Cedar Point crabber, says the river has been good to him in the 22 years he's worked it. "It's fairly healthy as far as making a living off it," he says. He has seen water quality change, though, as the shoreline has developed and the river flow has altered.

"We're slowly losing it. I figure it will be good for my lifetime," he says. His son-in-law might not be so lucky. "He'll have problems down the road," Howell says.

Shellfishers already suffer after thunderstorms. "If we get an inch-and-half of rain, they've got to go elsewhere. It really hurts them when they close the river."

SEEKING SOLUTIONS

While increased storm water runoff from the widened N.C. 24 presents new complexities, many complain the highway has been ruining the river since the road was built in the 1950s. The bridges and causeways interrupt the tide's natural course to and from Bogue Inlet, some say, so the White Oak can't cleanse itself. Intracoastal Waterway dredging also is suspect.

"If you stop the ebb and flow of a river, the thing will die," says Ray Harris, Carteret County extension director, who lives on the White Oak near Stella.

As highway widening plans developed in the 1990s, residents feared more pavement would exacerbate shoaling as well as runoff. Harris and his Onslow County counterpart took those worries to the N.C. Cooperative Extension Service. Together, the service and concerned citizens got a U.S. Department of Agriculture grant to fund scrutiny of the plans.

The citizens and other "stakeholders" — known as the White Oak River Watershed Advisory Board — worked with local governments to convince the N.C. Department of Transportation to redesign parts of the expansion to reduce runoff. The board also expects a federal flow study of the river.

Like many, Harris' interest in the White Oak is personal as well as professional. He loves to watch the sunset paint the water different colors, and to see stars reflected on the surface at night. Even with its troubles, he says, the White Oak is one of the East Coast's finest rivers. "And we definitely do not want to mess it up."

The White Oak advisory board became the pilot watershed planning group for N.C. Cooperative Extension's Watershed Education for Communities and Local Officials (WECO), aimed at educating communities in how to address their own water quality issues. Barbara Doll, Sea Grant water quality specialist, has been part of the ongoing outreach effort.

After success with the highway redesign, the advisory board took on other sources of storm water runoff that cause shellfish closures. WECO and the advisory group teamed up with the NC State College of Design, the town of Swansboro, N.C. Shellfish Sanitation Section and Duke University to obtain a $300,000 Environmental Protection Agency grant aimed at improving shellfish waters around Swansboro and Pettiford Creek, an estuarine tributary.

In Swansboro, dwarf yaupon, daylillies, spirea and other selected species are planted in two prominently placed rain gardens.

"Rain gardens are designed to slow down storm water runoff and let it percolate into the ground," says WECO's program coordinator Christy Perrin. "And there is some nutrient uptake by the plants themselves." A permeable pavement parking lot is under construction. The demonstration projects illustrate "best management practices" that mitigate urban storm water runoff.

In Pettiford Creek, the goal is to reduce harmful runoff from a varied landscape. Broad-based teamwork involves WECO, NC State's College of Design and Department of Biological and Agricultural Engineering, Duke Marine Lab, N.C. Shellfish Sanitation Section, Carteret County Cooperative Extension and the community as a whole. A class of fifth-graders got into the act, with a portrait of the area and its occupants, including four-footed ones.

"We got a big group of volunteers to help us survey the watershed. We recorded the characteristics of the watershed that can help us to identify potential sources of pollution and transport mechanisms, such as the number of dogs, and where the ditches are located," Perrin says.

Once the data is analyzed, residents again will be called to action. "We'll ask the community to come out and help us determine how we can reduce the amount of pollution reaching the creek," Perrin says.

TAKING CARE OF THE RIVER

The WECO projects coincide with the litter cleanup and other efforts by groups, government agencies and individuals on behalf of the White Oak. Croatan National Forest's latest management plan promises to protect the "remarkable values" of the White Oak. Recreational users are trying to remove storm debris blocking streams.

"There's a lot of people doing a lot of different things," Perrin says. "So it works well together."

Sally Steele, who lives on Pettiford Creek and is the development director for the Coastal Federation, describes a kayak outing that brought unforgettable encounters.

"We went out into the river, and we had these giant green shrimp hitting up against our kayaks. And, a little while later, we were surrounded by dolphins," Steele says. "When you have an experience like that you think: We have to take care of this river." ◘

FOR MORE INFORMATION

- *Crystal Coast Canoe and Kayak Club:* www.ccckc.org
- *N.C. Cooperative Extension's Watershed Education for Communities and Local Officials:* www.ces.ncsu.edu/depts/agecon/WECO
- *White Oak River Basinwide Water Quality Plan, N.C. Division of Water Quality:* http://dem.ehnr.state.nc.us/basinwide/whiteoak/2001/whiteoak2001.htm
- *NC Coastal Federation:* www.nccoast.org
- *Croatan National Forest:* www.cs.unca.edu/nfsnc

ONE MAN'S TRASH

Elmer Eddy, 83, is known as "The White Oak River Trash Man."

Nothing seems to stop Elmer Eddy in a canoe. He climbs over beaver dams. He breaks ice with his bow. He smiles at snakes, admires alligators and just keeps going, no matter what he encounters. Except litter. Even the littlest bit of litter.

A compulsive cleaner of waterways, not so much as a gum wrapper is left behind when "The White Oak River Trash Man" paddles past.

He and the Stewards of the White Oak River Basin declared the White Oak litter-free last fall, an unprecedented claim. Eddy was the force behind the two-year effort that earned him his "Trash Man" nickname, and Keep Onslow Beautiful Committee's highest honor, the Robert L. Franck award. He, though, modestly deflects credit to the hundreds who helped take out the trash on the White Oak and its tributaries.

For him, reaching for rubbish comes easy. "It's more fun to me to pick up the trash than to leave it, really," says Eddy. "I would worry about that piece of trash all day if I left it."

He cleans as he goes, but his real quest is adventure. A lifelong canoeist, he still paddles weekly year-round at 83. "I go right to the end of everywhere, as far I can go," he says, "And I get surprises everywhere."

He e-mails fellow paddlers photos of his finds — wild azaleas, forgotten bridges — with invitations to join the next outing. Eddy's vintage red pickup stays armed with canoes, kayaks, trash bags and signs imploring "Please Don't Litter," his constant plea. He wants to make a no-litter pledge a driver's license requirement.

Retired from the insurance business, Eddy and his wife, Florence, moved to Swansboro three years ago from Raleigh, where he had spent many discouraging days picking debris from the lengthy, littered Neuse. The smaller White Oak presented an achievable challenge.

"It begins and ends right here," he says. "So we've got pretty good control over it."

Eddy was proud to pronounce the river clean. Then, disappointment followed.

"I thought that if we got the White Oak River cleaned up, it would be a shining example that it can be done, and it would be transferred to other rivers," he says. "But everybody ignores trash."

Nobody who meets Eddy can ever again ignore trash, some contend.

"He changes attitudes," says Sally Steele, who lives on a White Oak creek, and helps coordinate the annual Big Sweep locally. "He makes you stop and pay attention." Thanks to Eddy and his volunteers, the river returned little litter during the latest Big Sweep.

Eddy's energy leaves many half his age in awe. "He runs me into the dirt most days when we paddle together," says Pam Bader of Emerald Isle. Eddy's commitment and personable manner motivated her — and many others — to join the crusade.

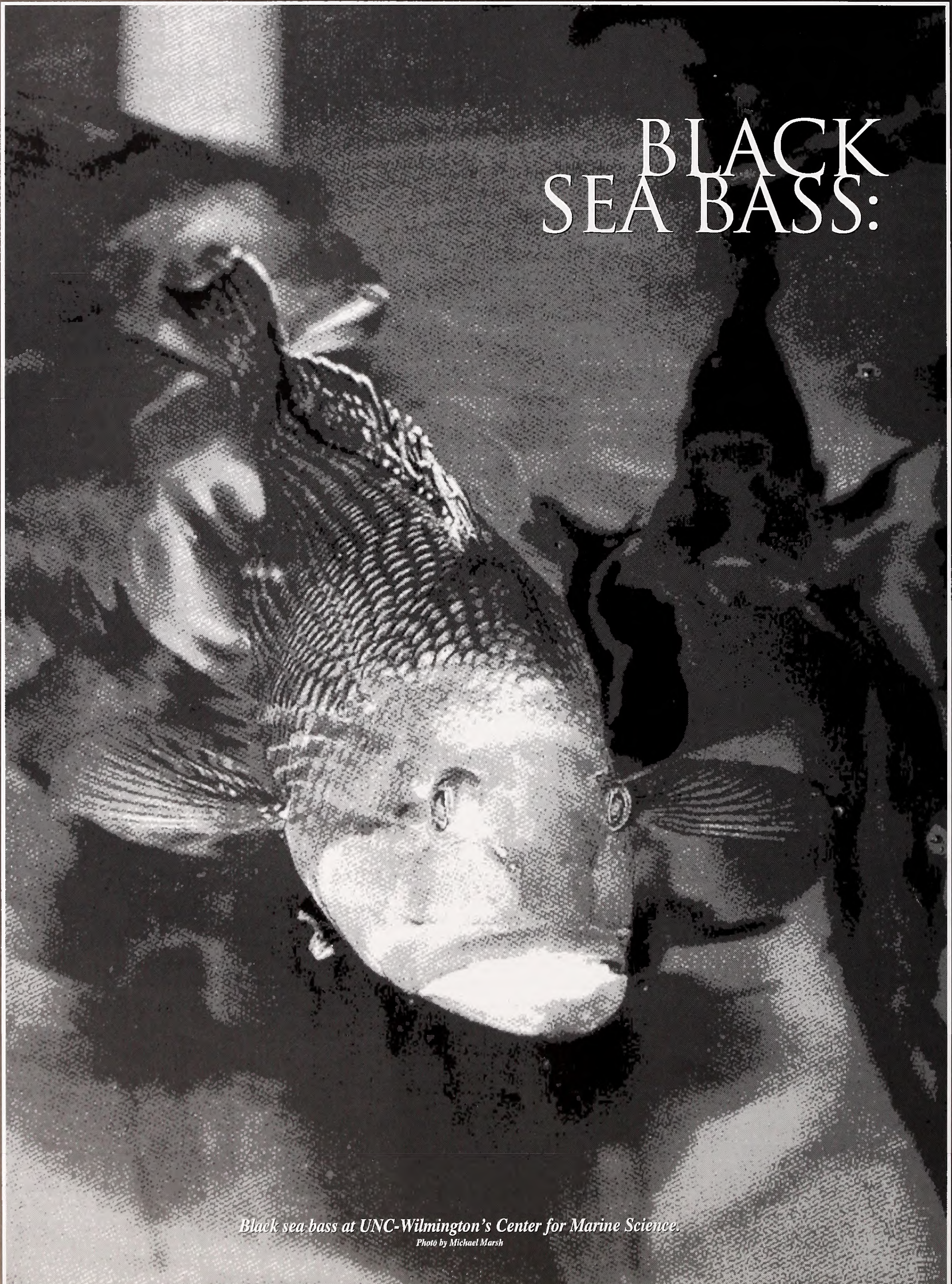
"He inspires and leads by example, and that is a wonderful gift. He makes me want to be a better person and gives me hope that all is not lost. People do still care, and people are trying to make a difference," she says. "We need a couple of million with that zeal."

Jamie Cameron of Swansboro paddled many miles with Eddy, following the cleanup campaign for the *Tideland News*. "This was a great effort born from an idea that Elmer had when he first floated the river," Cameron says. "He's so passionate about what he does. Now that he's finished this river, he's branched out. He can't stop."

Eddy is now leading the charge to clean the New River. When people warn him the New is much messier than the White Oak was, Eddy grins. "We can do it," he says. "We're going to do it."

Interested in cleaning up a waterway near you? Contact North Carolina Big Sweep at 800/27-SWEEP or go online to www.ncbigsweep.org. — J.A.P.

BLACK SEA BASS:



Black sea bass at UNC-Wilmington's Center for Marine Science.

Photo by Michael Marsh

AQUACULTURE OPPORTUNITIES

By Cynthia Henderson

Charter boat captain Carl Snow and University of North Carolina at Wilmington researchers have made a discovery: When it comes to black sea bass, you may be able to have your fish and eat it, too.

As appetites for seafood have grown, so have concerns for depleted fish stocks. Currently, black sea bass is listed on the N.C. Division of Marine Fisheries Web site as a "species of concern" south of Hatteras and, north of Hatteras, as "overfished."

Many see aquaculture, or fish farming, as an alternative that can relieve commercial pressure from wild species, but little work has been done with farm-raising black sea bass in North Carolina. Until now.

A project at UNC-W studying black sea bass aquaculture started a few years ago when a fishing captain's observations and a scientist's expertise joined forces through an innovative grant opportunity. The Fishery Resource Grant (FRG) program is funded by the N.C. General Assembly and administered through North Carolina Sea Grant. It blends science with practical fishing experience to find ways to improve and protect the state's fisheries.

For more than 40 years, Snow has been involved in fishing endeavors — from operating the charter fishing boat, the *Fish Witch II*, to running, along with wife Missy, a seafood market and packinghouse. He has aquaculture experience in shedding blue crabs and specializes, in the winter and spring, in fishing commercially for black sea bass.

Snow's catches of the fish have gotten smaller in recent years, he says. "But different fishermen would argue about that. They say fish come in cycles … If that's so, the last few years have been a down cycle. I don't think there are as many fish out there," he says.

Despite the apparent vulnerability of black sea bass populations as a whole, Snow notes a particular resilience in the individual fish. He says they thrive in the holding tank of his boat during trips from the fishing site to the docks — trips that can take more than two hours.

Kim Copeland harvests a sea bass from the Phase II density study. This fish was destined for New York City.

(Photo courtesy UNC-Wilmington)

"Of all the bottom-feeding fish, sea bass are definitely the hardiest," he says.

That's what got him thinking of using sea bass for aquaculture. And while he was thinking about it, North Carolina Sea Grant fisheries specialist Jim Bahen called to tell Snow about the FRG program.

That timely call became the catalyst for the project. The conversion to scientific study began as Sea Grant paired Snow with Wade Watanabe, a research professor focusing on marine aquaculture at the UNC-W Center for Marine Science.

A SCIENTIST'S PERSPECTIVE

Watanabe's experience with marine and freshwater aquaculture of finfish has taken him all over the world. For Snow's idea for an FRG project, Watanabe was in the right place at the right time.

A native Hawaiian, Watanabe knows a thing or three about seafood, as well as sea science. He says the firm, white flesh of black sea bass is amenable to a variety of culinary treatments, including — but not limited to — Asian cooking techniques. It is especially good as sushi, says Watanabe, who admits to a fondness for the uncooked delicacy.

For Watanabe the scientist, the fish's culinary merits are superceded by traits such as tolerance for different temperatures and salinity concentrations.

"They display some very good attributes for aquaculture," he explains. And that can have implications for the species in the wild.

The business of aquaculture tends to spawn, so to speak, hatchery technologies that can supply fingerlings to be grown out in fish farms, Watanabe says. And this is where he sees a "transition between commercial fishing and aquaculture."

"The fingerlings also could be used to replenish natural stocks," he says. "It's another potential application of hatchery technology."

This use of fingerlings produced in hatcheries has precedent with other marine finfish species. Hatchery-raised red drum have been released to the wild in Texas and South Carolina, Watanabe says.

Continued

Future studies may show the impacts of such releases on wild stock.

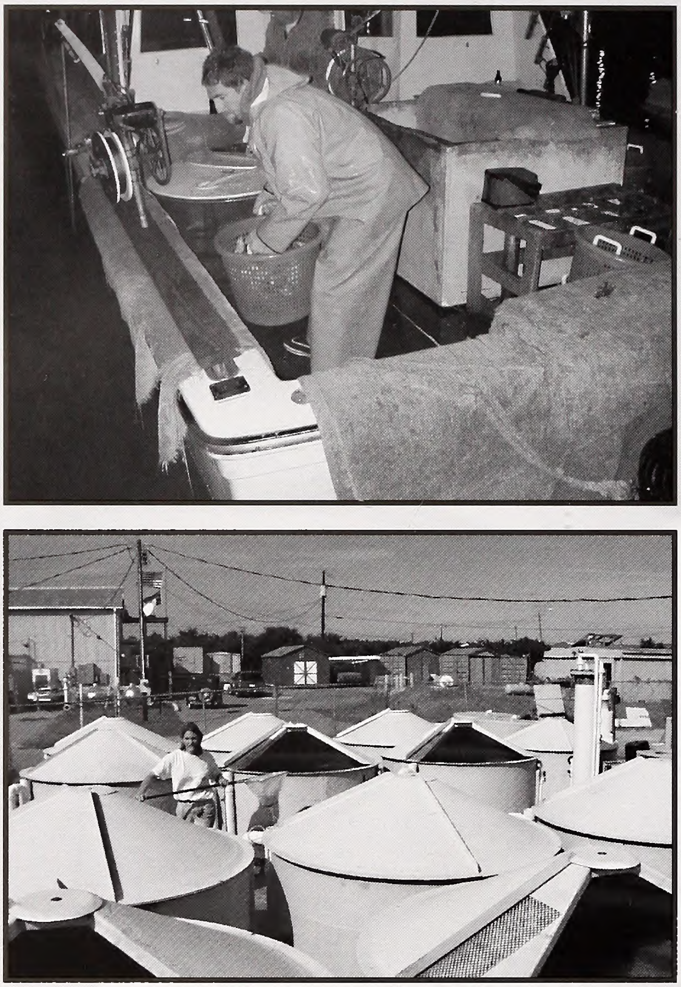
The sea bass research represents a progression from commercial fishing to aquaculture. In the first FRG project, small but legal-sized black sea bass trapped by Snow demonstrated successful growth rates when given practical, commercially available feed. A second study showed the fish are tolerant of relatively high stocking densities.

Now, a new FRG project is focusing on spawning, using some of the original wild-caught stock.

APPLYING SCIENCE

"I think the best thing I've enjoyed about this project is that everything I've said (about black sea bass) has been proven right," says Snow.

One thing that impresses Snow is how many additional people it takes to increase the scientific validity of an FRG project like his — North Carolina Sea Grant staff, academic researchers like Watanabe to design and oversee the experiments, and students who do much of the lab work.



TOP: Captain Snow's first mate, Jeff Jugan, delivers just-caught sea bass for the Fishery Resource Grant study. (Photo by Kim Copeland)
BOTTOM: Kim Copeland amid the recirculating system at the UNC-W Center for Marine Science facility at Wrightsville Beach. (Photo courtesy UNC-W)

Kim Copeland was a graduate student in marine biology when she started working on the project at the beginning, in 1999. Watanabe says her work has been "crucial" to the project's success.

Now a research associate, Copeland has witnessed the growth of the project and of the black sea bass — from weighing and measuring the fish to compiling and analyzing the data. She went out a couple of times with Snow to see how black sea bass trapping was done, and hauled the fresh catch back to the university's Wrightsville Beach lab.

From what she's seen, she agrees with Snow that these are some resilient creatures.

Most fish species brought in to the lab require "feed-training," she says, and must be introduced to artificial feed gradually.

Some, like the flounder used for broodstock, won't take pellets at all. They eat only fish called silversides that have been frozen, then thawed. The labor and processing involved in meeting the exacting requirements of such picky eaters hikes up aquaculture costs.

But the bass took to the commercial feed readily — a rare event "anytime you're taking fish from the wild and putting them in an artificial environment," Copeland says.

And, attesting to their hardiness, Copeland explains that the mortality rate from the acclimated fish during the feeding study was zero. Even given some mortalities early on from transporting and holding, she says the statistics are impressive.

A potential drawback for black sea bass aquaculture, says Watanabe, is the relatively slow growth rates in wild populations of this species, which can grow to seven pounds and 24 inches long. In the study, Watanabe says growth rates proved to be much faster than in the wild.

So far, so good. But in order to be feasible for farm-rearing, the fish must tolerate stocking in tanks at numbers that will mean profit to the aquaculturist.

Using results from the feeding study, the second FRG looked at how adaptable the black sea bass were to different stocking densities. The CMS facility uses recirculating tanks — a "closed" system in which water quality is managed using biological and mechanical filtration with ultraviolet water sterilization. Heat pumps control water temperature.

The black sea bass did well with more fish per tank. Another study funded by the U.S. Department of Agriculture is looking at stocking densities high enough for profitable aquaculture.

But to say the fish tolerated more crowded conditions isn't to say they were unaffected.

"Ours had higher body fat content, but enhanced value as a sushi product where higher fat content seems to be preferred," Watanabe says.

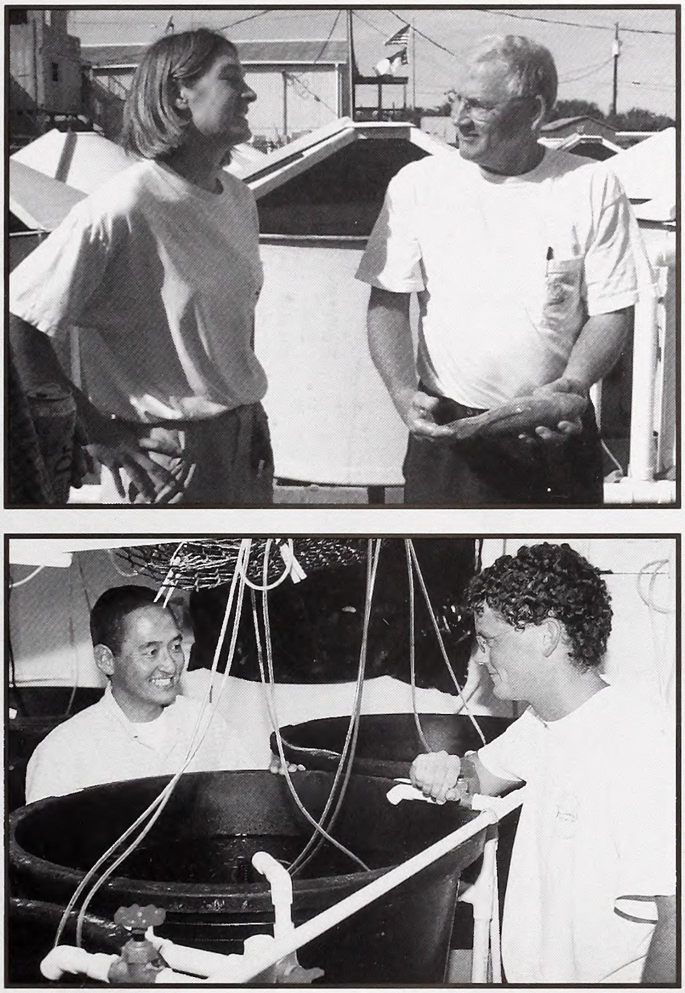
Fat content is a characteristic that may be controllable in aquaculture by manipulating feed and the amount of exercise the fish get in the tanks, he explains.

THE PROOF IS IN THE EATING

No one needs to tell Captain Snow that black sea bass is delicious.

"You can't beat a sea bass. It's a great eating fish," he attests. Even though Snow and his wife can get all the fresh fish they want year-round, Snow says they like sea bass so much they freeze it — just so they can have it in the summer, too.

In December 2001, the fish from the study were submitted for a taste test at Elijah's



TOP: Kim Copeland and Captain Carl Snow harvest black sea bass from the stocking density study. (Photo courtesy UNC-W)
BOTTOM: Wade Watanabe, left, and Scott Wheatley check out a larval-rearing tank at the CMS hatchery building. (Photo by Pam Smith)

Restaurant in Wilmington's waterfront area. It was a grand debut for the subject of an experiment, with a tasting panel that included UNC-W Chancellor Jim Leutze and local media.

The fish samples were served four ways — fried, blackened, stuffed with lobster and as sushi.

The sushi was the preferred dish at the tasting, says Kevin Yates, a UNC-W graduate student in marine science who worked on marketing for the project. However, some tasters declined the sushi, which may have skewed the results, Yates explains. Sushi afficionados were likely the ones who rated that dish so high.

All in all, the black sea bass was well received. On a scale of one to five, most dishes scored higher than four, says Yates.

Since the taste test, the black sea bass from the project have continued to get rave reviews.

Yates took some of the fish to the Fulton Fish Market in New York, which he describes as a "huge open-air wholesale market" and one of the largest seafood markets in the world. The fish were cut open right there, he says, and passed around as sushi. "They look at thousands of pounds of fish per day and really liked it," he says.

"That's when I came to the realization that we really had something here to target the sushi market with," says Yates, explaining that means higher profits for the supplier.

In Maryland, the test-marketed bass brought $5 a pound, whole and on ice, even at weights less than the 2.5 "jumbo" size, according to Copeland. Commercially, jumbos normally bring $4 to $5 per pound at the most, she says.

For "live-hauled" fish, Yates says the black sea bass can bring much more at large, metropolitan markets.

Prices fluctuate considerably, based on market demand. The best way for the aquaculturist to gauge selling price is to find the current wholesale rates for wild-caught species, says North Carolina Sea Grant Director Ronald G. Hodson, a nationally recognized expert in marine finfish aquaculture.

The sea bass have received accolades close to home as well as in New York and Maryland.

"We have test-marketed the fish to a local market in Wilmington, and they're always calling and asking if we have more fish," Copeland says.

OUT OF THE LAB, INTO THE WORLD

Given the results from the projects so far, Snow says he plans to pursue black sea bass aquaculture.

He explains that his setup will differ from the university's system that filters and recirculates water.

"I happen to be very fortunate, because I live on the water," he says. He plans to pump in sea water for his operation.

Buying tanks, pumps and filters for a recirculating system would be more expensive, Snow says. "But that's just a one-time thing," he adds. "I feel like, if someone was serious about trying to do it for a living, it would be profitable."

Watanabe explains that, as the business of finfish aquaculture develops, it tends to progress from a system that relies on wild-caught fish to a method in which wild stock is spared. Ultimately, through the hatchery technology that arises to supply fingerlings to the aquaculturist, wild stocks can also be replenished.

"With support from the FRG program," Watanabe says, "we tested out Captain Snow's idea of taking small, wild-caught black sea bass and growing them to a larger premium market size before sale. If Captain Snow were to practice this concept, he would actually be growing fish that are produced in the wild, a practice known as 'on-growing.' In closed-cycle aquaculture, the farmer no longer relies on the capture of wild fish to stock his tanks, but rather on fingerlings produced in a hatchery."

Meanwhile, the sea bass research goes on.

Some of the fish grown out in the study were used as broodstock and induced to spawn using hormones and regimes regulating exposure to light and temperature.

Copeland says the current study is going well. Fish produced in the lab two to three years ago will, she hopes, reach sexual maturity soon. If they successfully spawn, she says, "it will close the life cycle" for the fish raised in captivity. Watanabe and Copeland say that this is the first time, to their knowledge, that this has been accomplished for this species.

The feat will bring the research full circle, helping to establish the feasibility of commercial aquaculture of black sea bass along with its implications for replenishing a species. ▣

On the Refuge Road: The National Fish Hatchery

By Pam Smith

Photo by Michael Halminski

For more than a century, the Edenton National Fish Hatchery has been growing "crops" of shad and striped bass to stock streams in North Carolina, South Carolina and Virginia.

It's a good bet that the next striped bass you catch could trace its origins to the Edenton National Fish Hatchery. To the delight of recreational anglers, nearly a million stripers cultured each year at the hatchery are destined for streams in North Carolina, South Carolina and Virginia.

"Sometimes Mother Nature needs a little help," hatchery manager Arnold Rakes says of the historic facility's fisheries restoration and recovery mission.

The Edenton National Hatchery is one of 12 North Carolina sites under the aegis of the U.S. Fish & Wildlife Service's (F&WS) National Wildlife Refuge and National Fish Hatchery System. Interestingly, the hatchery predates the century-old refuge system.

The country was still young when once-abundant fisheries began to show signs of decline, Rakes recounts. Farming, droughts and floods, industrialization, population growth and commerical and recreational overfishing contributed to degraded fisheries resources across the nation.

Congress reacted in 1871 by creating the Commission on Fish and Fisheries and appropriating funds for the first national hatchery — a forerunner of today's F&WS Fisheries Program.

The Edenton National Fish Hatchery was established on Pembroke Creek in 1898 to address declining populations of warmwater fish species, including the American shad, striped bass and river herring — anadromous fish that move from ocean waters into freshwater spawning grounds. It continued to operate at that site until 1958. The hatchery resumed production from a new location a half-mile away in 1960.

More than a century since the hatchery's founding, the same fisheries — once the dietary mainstay of many North Carolinians — are still in trouble.

Today, the Edenton hatchery efforts focus on restoration of striped bass and shad, as well as the recovery of the Cape Fear shiner, an endangered minnow.

MISSION AND METHODS

The hatchery's restoration and recovery mission is unchanged, but hatchery methods have advanced exponentially over the years, says Rakes, a former fish culture trainer for the Fisheries Program.

Though he's been manager here for less than a year, Rakes is no newcomer to the Edenton complex. From 1980 to 1984, he served as an assistant to Elliott Atstupenas, long-time hatchery manager who retired in 2001.

Fish rearing was far from an exact science in the earliest hatchery days. Edenton hatchery workers followed fishers working pound nets during spawning season in nearby bays. They would collect female fish that were ready to spawn and transport them to hatchery tanks — and waiting wild-caught males. An unpredictable number of fertilized eggs would result from the tank-spawning process. What's more, staggered fertilization meant staggered hatching times and labor-intense efforts to sort fry for transfer from tanks to hatchery ponds.

Nevertheless, in the late 1930s, the late Kerry Bunch was one of the first hatchery managers in the country to culture striped bass in a hatchery environment, according to Atstupenas. By the late 1960s, hatchery managers were exploring more sophisticated scientific methods.

A significant breakthrough came in the late 1980s when Atstupenas collaborated with Craig Sullivan, a Sea Grant researcher at North Carolina State University.

"I see Elliott as the grand master of captive spawning in the reproduction of striped bass," Sullivan says of Atstupenas.

Together with Ronald G. Hodson, now Sea Grant director, they developed new techniques to induce ovulation in female striped bass by injecting special hormone implants into wild-caught female striped bass to accelerate egg development. Each female, they say, can produce around a million eggs per 10 pounds of body weight.

The rest is left to nature, Sullivan says. The natural courtship and spawning occur in the controlled environment of the spawning tanks. Similar techniques are applied to shad reproduction.

As a result of the science-based process, the cost ratio of the restoration of stripers and shad are excellent — a concrete economic benefit to citizens.

Moreover, Sullivan says, hatchery production in conjunction with fishery management plans are important factors in the comeback of striped bass. One day, the same success story may be told about the American shad, adds Sullivan.

Photo by Lucille Harrell

Photo by Michael Halminski

TOP: At one of the 36 ponds at the Edenton complex, hatchery manager Arnold Rakes harvests fish destined for stock restoration. BOTTOM: More than 12,000 annual visitors who meet Lucille Harrell and Ron Smith, park rangers, learn a lot about growing fish — and about the Roanoke-Tar-Neuse-Cape Fear Ecosystem.

ON THE REFUGE TRAIL

More than 12,000 annual visitors can attest to the fact that there's more to the Edenton hatchery than incubators and circulating tanks, says Lucille Harrell, park ranger.

Harrell greets visitors and provides interpretive tours of the complex that is a designated stop on the Charles Kuralt Trail of National Wildlife Refuges in coastal North Carolina. The trail honors the late North Carolina journalist who ended each of his *Sunday Morning* television programs with nature film essays — many produced in wildlife refuges. Each site on the Kuralt Trail is marked with a red-roofed kiosk displaying information that explains special opportunities to experience nature.

At the Edenton hatchery, Harrell guides tourists through the visitors' center, where exhibits highlight the rich natural resources of the Roanoke-Tar-Neuse-Cape Fear Ecosystem.

An aquarium features the freshwater fish species found in coastal river systems. Yes, Harrell says, the fish are reared on premises. Currently, the largest aquarium inhabitant

Continued

is a striped bass, a "keeper" at 20 inches. A large, fat catfish is a close second.

The efficient red brick building housing the visitors' center, aquarium, classroom and administrative space shields the vast system of ponds from the traffic rushing past the Queen Street complex.

Harrell notes that the 36 ponds account for 25 water-filled acres during the height of the "growing season." There are 29 ponds for striped bass and six for Cape Fear shiners and other fish. Another is designated as a "public use" pond. The shad bypass the ponds and go from tanks to other grow-out hatchery sites.

During National Fishing Week, the first week of June, school children converge on the hatchery for an annual Fishing Rodeo. Volunteers are matched with the young anglers for a day of guided fishing fun. Wheelchair-bound citizens and others with special needs also have an assisted fishing opportunity.

Beyond the ponds and fish barns, a boardwalk leads to Pembroke Creek. The beauty of the dark, flowing waters, outlined by moss-covered trees, could easily be a *Sunday Morning* closing scene.

Harrell's duties take her far from the tranquil setting several times each year. She is the hatchery's "public face" at the North Carolina State Fair, Seafood Festival, Commercial Fishing Show, boat shows, and other events that fall under her outreach-and-education hat.

Last year, when the hatchery was in a search mode for a new manager, Harrell rolled up her sleeves and put on her aquaculture hat to help with the production.

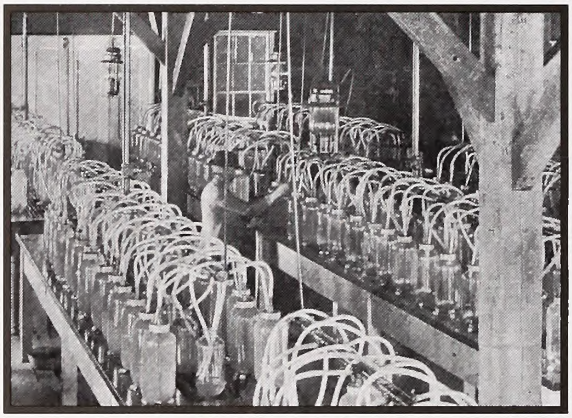
"It's a lot like farming. We plant in spring and harvest in the fall," Harrell says.

ROOM TO GROW

"Spring is a busy time," Rakes says. "It takes more than 20 days to fill the ponds."

In April, the ponds are filled with water from three sources: brackish Pembroke Creek, a freshwater well and a low-salinity water well.

Photos courtesy of the Edenton National Fish Hatchery Archives



TOP: In the early 1980s, Rakes, right, served as an assistant to long-time hatchery manager Elliott Atstupenas, who retired in 2001. BOTTOM: At the turn of the 20th century, rearing shad at the hatchery required a complicated laboratory system of jars and tubes.

By then, the hatchery breeding process is well under way. Personnel from the hatchery and other state agencies gather wild female and male shad and striped bass from nearby rivers, streams or sounds using electrofishing methods to minimize stress on the fish.

The fish are transported in hauling trucks equipped with oxygenated circulating tanks to waiting hatchery aquaculture tanks, where they are monitored for egg maturation.

The fish are allowed to acclimate to their new surroundings before the laboratory breeding process is put into play.

New life for shad and stripers begins with a fertilized egg in the closed-system hatchery tanks. Hatching occurs in about 36 hours, with transparent larvae about 4 mm in length. Both shad and striper larvae thrive on hatchery-grown brine shrimp for about five days.

The 5-day-old shad fry are shipped to other grow-out facilities. The striped bass are ready for transfer to hatchery rearing ponds, where they will feed on a natural diet of zooplankton for about a month — from mid-April through May.

The ponds then are drained and the fish, now about two-inches in length, or Phase I fingerlings, are harvested for stocking. Some will go to inland reservoirs and streams in North Carolina, Virginia and South Carolina.

The remaining striped bass fingerlings will be restocked into hatchery ponds, where they are fed a prepared diet for several more months until they reach a size of about 4 to 6 inches in October. These Phase II stripers are earmarked for stocking coastal river systems.

There's a chance that discussions with North Carolina and Virginia resource agencies could result in the hatchery tripling its American shad production this year. Officials are studying how a certain dam is affecting the spawning habits of shad as they travel upstream to spawn.

"There's a lot of potential for us to meet even greater restoration needs," Rakes says with confidence.

The Edenton National Fish Hatchery is one of 66 across the country. All fish reared at national hatcheries are stocked into public waters. ◘

The Edenton National Fish Hatchery is open to the public year-round for self-guided tours. Arrangements for tours led by station personnel may be made in advance.

For information about the annual fishing rodeo and hatchery open house, call 252/482-4118.

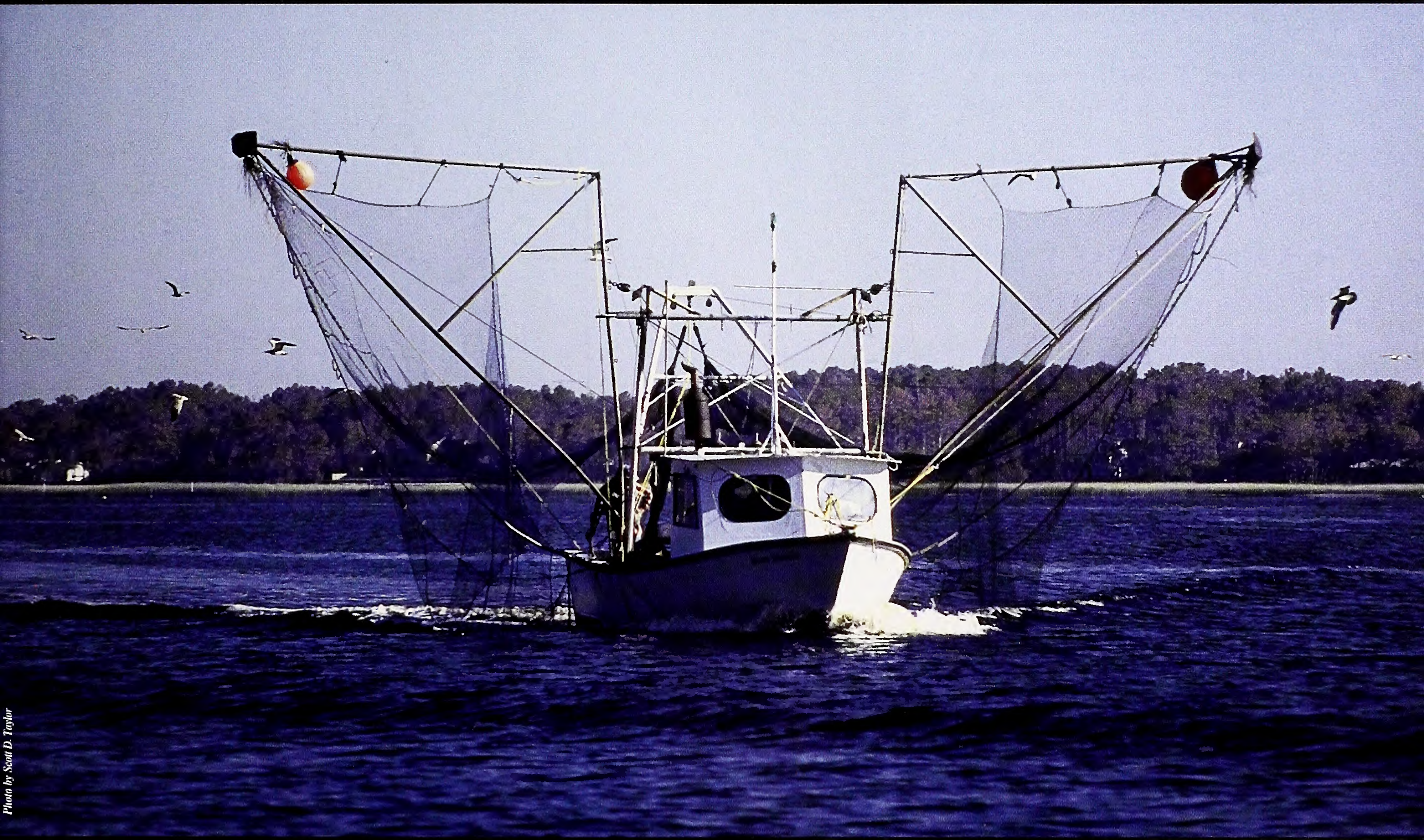


Photo by Scott D. Taylor

Skin Cancer Project Targets Fishing Community

By Ann Green

Doctors have long known that fishers and other workers who spend a lot of time in the sun are at increased risk for skin problems — from rashes to skin cancer. In an East Carolina University study, nearly 25 percent of the North Carolina fishing community interviewed reported having skin disorders, according to North Carolina Sea Grant researcher David Griffith.

Despite having skin problems, fishers often don't seek medical treatment for the maladies.

Continued

"Many fishermen say they can't afford treatment for skin problems," says William Burke, chief of Division of Dermatology, the Brody School of Medicine at East Carolina University. "Many don't have any health insurance. We often reach the fishermen by educating their wives."

To educate the North Carolina fishing community about skin problems, the N.C. Agromedicine Institute — a collaborative program between East Carolina University, North Carolina State University and N.C. A & T State University — is conducting a three-year pilot study. The institute, based at ECU in Greenville, also focuses on the occupational risks of foresters and farmers.

The skin cancer project, funded by the National Institute for Occupational Safety and Health, will provide educational materials for the fishing community. Griffith and Burke are the project's co-investigators. Recently, North Carolina Sea Grant helped develop a skin cancer poster to distribute to fish houses and other places frequented by fishers.

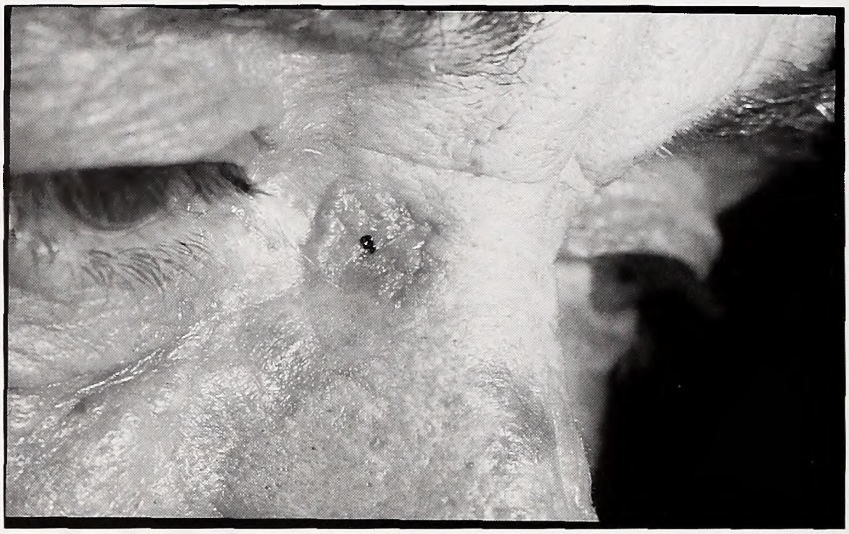
"Many farmers and fishermen are aware of the dangers of the sun, but often believe that it does not affect their ability to work," says East Carolina University medical student Chris Scott, who has made skin cancer prevention presentations throughout Eastern North Carolina. "By limiting their sun exposure, they can delay or cut their risk of skin cancer."

CRUCIAL SCREENINGS

Burke and others also are conducting skin cancer screenings in North Carolina, Alabama and Maryland. "So far, we have tested 59 fishers in North Carolina and found that many have precancerous lesions," says Burke. He also has diagnosed five cases of skin cancer.

The two most common types of skin cancer are basal and squamous cell cancer. Basal cell cancer accounts for more than 90 percent of all skin cancers in the United States. These cancers are slow-growing and seldom spread to other parts of the body.

"Basal cell is treated surgically and is easy to treat if caught early," says Burke. "It comes from cumulative exposure and damage from the sun — and has little chance of metastasizing."



LEFT: Basal cell carcinoma, which accounts for more than 90 percent of all skin cancer in the U.S., is slow-growing and seldom spreads to other parts of the body.

Squamous cell cancer also is caused by chronic outdoor activity. It is treated surgically and has little chance of metastasizing, unless it occurs on the lip where it has a higher chance of spreading, according to Burke.

Malignant melanoma, the most rapidly increasing form of cancer in the United States, causes approximately 75 percent of all skin cancer deaths. This disease can spread to other organs, most commonly to the lungs and liver.

"People who get a bad sunburn early at age 2 to 5 are more likely to get melanoma," says Burke. "It is more common in fair-skinned people but can occur in black people. Almost all commercial fishermen in North Carolina are of Celtic descent or fair-skinned."

Besides skin cancer, Burke has found numerous other skin problems in the fishing community.

"Most fishermen laugh if they are asked about skin problems because some kind of problem comes up almost daily," says Burke. "One common problem is stingray injuries that can get infected if not treated properly and trauma to the skin from the pinching of crabs."

Skin cancer is the most common form of cancer in the United States. More than one million cases likely were diagnosed in 2002, according to the Centers for Disease Control and Prevention.

In a Maryland study, fishers who spent a lot of time on the water had a 2.5 times higher risk of developing squamous cell carcinoma than those who spent less time in the sun.

To find out more about skin problems in North Carolina's fishing community, Griffith is conducting a survey.

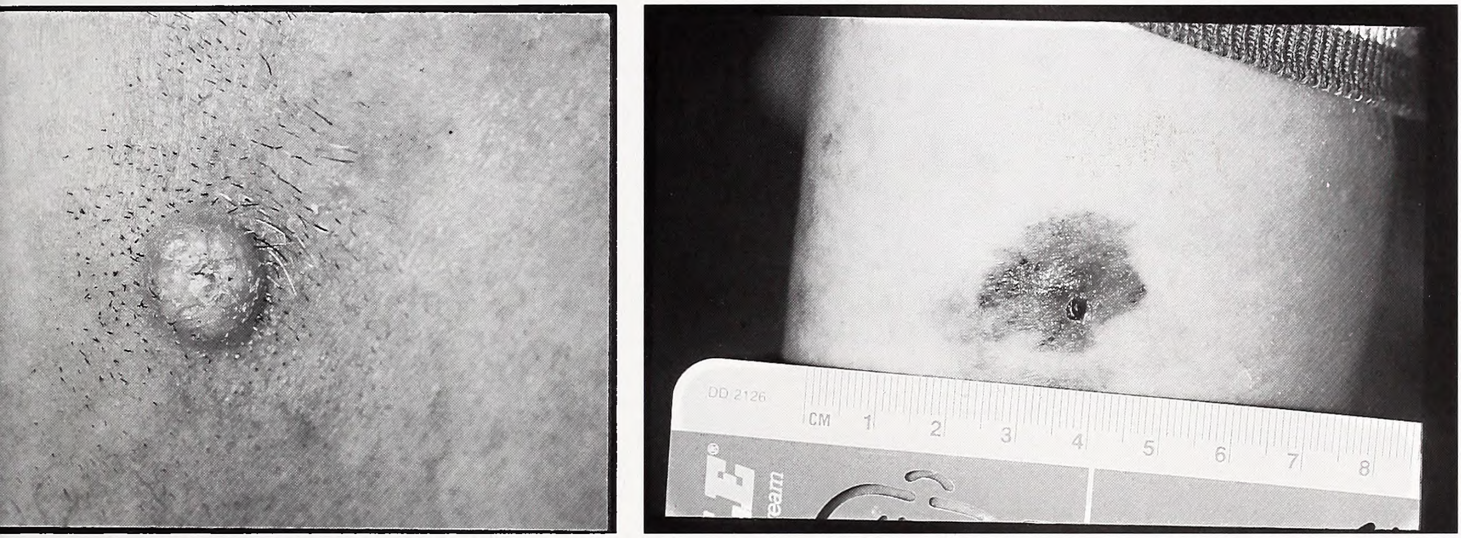
"The questionnaire will be mailed out to more than 300 commercial fishermen in the southeast region," says Griffith, an ECU anthropologist. "We also will be interviewing health professionals about how often they see skin cancer in commercial fishermen."

CAUSE OF SKIN CANCER

According to current estimates, 40 to 50 percent of Americans who live to age 65 will have skin cancer at least once. Although anyone can get skin cancer, the risk is greater for people who work outside and have fair skin that freckles easily — often those with red or blond hair or light-colored eyes.

The risk is also higher in places where there is intense year-round sunshine. In the United States, the highest incidence is in Arizona. Because eastern North Carolina receives high levels of UV radiation from the sun, residents are at high risk for skin cancer.

"The summer months are the worst



Photos courtesy of the N.C. Agromedicine Institute

MIDDLE: If treated surgically, squamous cell carcinoma has little chance of metastasizing, unless it occurs on the lips, where it has a higher chance of spreading. RIGHT: Malignant melanoma, the most rapidly increasing form of cancer in the U.S., can spread to other organs, most commonly to the lungs and liver.

because the sun is higher in the sky and less ultraviolet light is filtered," says Burke. "However, the winter months aren't safe because there is some ultraviolet light. I normally tell people to stay out of the sun from 10 to 3, but commercial fishermen can't do this because of their work."

Reflective ultraviolet radiation is as damaging as direct UV radiation. Water reflects up to 100 percent of UV radiation.

Typically, people don't develop any type of skin cancer until after age 50. However, outdoor workers often develop it at an earlier age. Sun damage builds up slowly and quietly.

The most common warning sign of skin cancer is a change on the skin, especially a new growth or a sore than doesn't heal. Skin cancers don't all look the same. The cancer may start as a small, smooth, shiny, pale, or waxy lump, or it can appear as a firm red lump. Sometimes, the lump bleeds or develops a crust. Skin cancer also can start as a flat, red spot that is rough, dry or scaly.

Both basal and squamous cell cancers are found mainly on areas of the skin that are exposed to the sun — the head, face, neck, hands and arms. However, skin cancer can occur anywhere. Changes to moles also are worrisome.

BEST DEFENSE

To prevent skin cancer, follow these simple steps from the American Cancer Society.

SLIP on a long-sleeved shirt.

SLOP on sunscreen with SPF 15+ to 30+ for fair-skinned individuals. Lip balm with sunscreen also is recommended.

SLAP on a wide brim hat. Ears, noses and lips are common sites of skin cancer.

Prevention of melanoma is obviously the most desirable weapon against the disease. But if a lesion should develop, it is often curable if caught in the early stages. To aid in early recognition of any new or developing lesion, periodic self-examinations are helpful.

"Always remember when you're working on the water, you're also working on cancer," says Burke. "Remember to protect your skin from the sun." ◘

For more information, call N.C. Agromedicine Institute, Brody School of Medicine at East Carolina University, 252/744-1000 or visit the Web: www.ncagromedicine.org. *To order a skin cancer poster, call North Carolina Sea Grant, 919/515-2454 and ask for UNC-SG-02-10.*

PROTECT EYES FROM SUN

When exposed to the sun's ultraviolet rays, you can damage your eyes as well as skin.

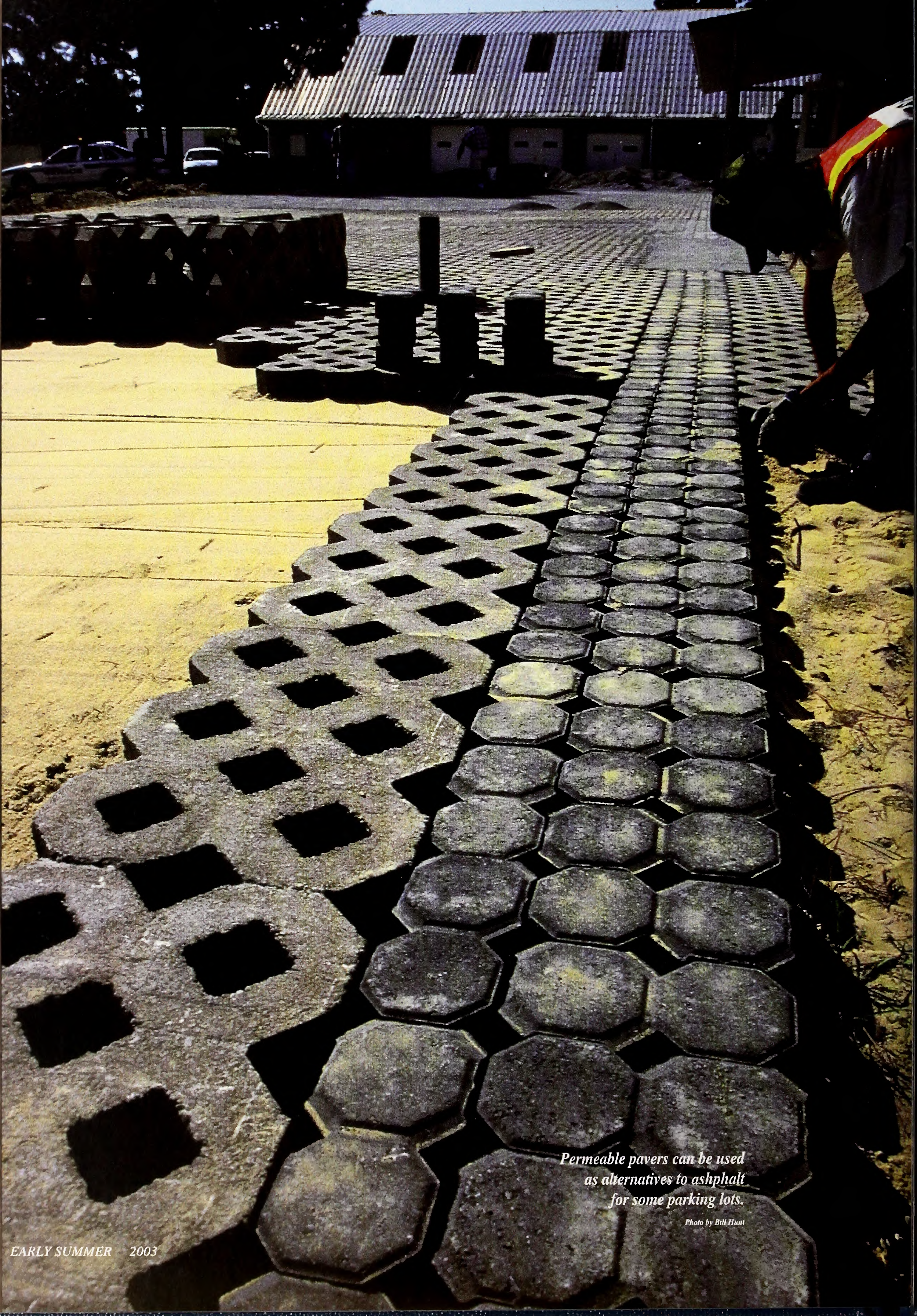
Research shows that cumulative exposure to the sun may increase one's chances of developing cataracts.

The sun causes other eye problems — from skin cancer around the eyes to macular degeneration.

"Anybody who goes outside should wear sunglasses that are polarized," says William Burke, chief, Division of Dermatology, Brody School of Medicine at East Carolina University.

Burke recommends that fishers and others protect their eyes with sunglasses. Effective sunglasses should block both UVA and UVB radiation.

To learn more about eyes and sun exposure, visit *www.aad.org/pamphlets/*and click on "ultraviolet index."

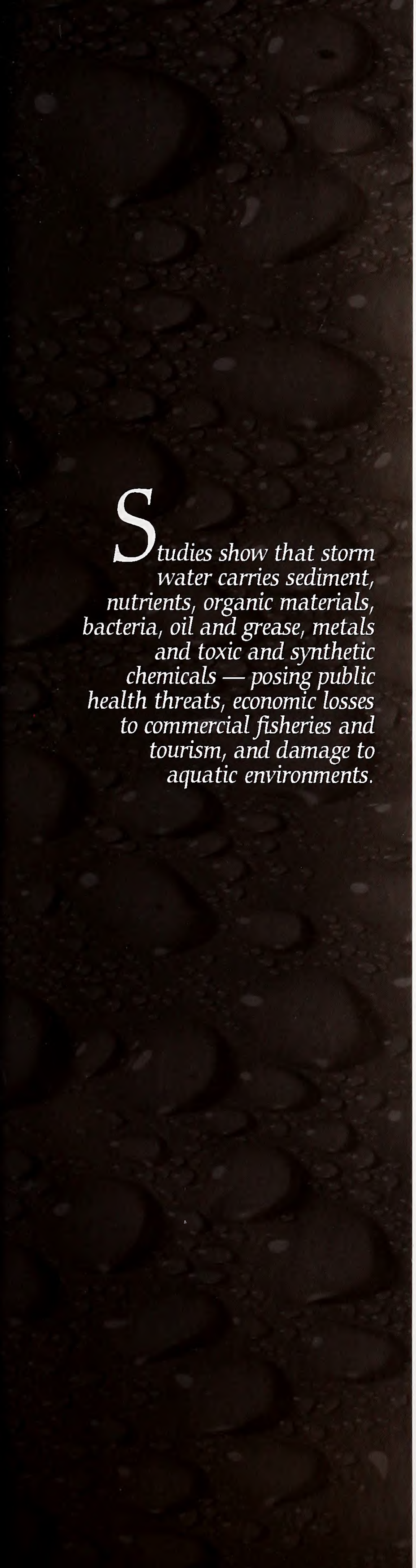


Permeable pavers can be used as alternatives to ashphalt for some parking lots.

Photo by Bill Hunt

Storm Water Management: A Coastal Imperative

By Pam Smith



Studies show that storm water carries sediment, nutrients, organic materials, bacteria, oil and grease, metals and toxic and synthetic chemicals — posing public health threats, economic losses to commercial fisheries and tourism, and damage to aquatic environments.

A sudden cloudburst can be a welcome relief on a blazing hot summer afternoon at the beach. Refreshing. Cleansing.

Or not.

It could mean that storm water cascading from drainpipes into coastal waters is depositing polluted runoff from surrounding parking lots, streets, commercial properties and fertilized residential lawns and gardens. It's enough to ruin the day for swimmers.

But that's not the half of it. Scientists say that storm water runoff is the leading cause of degraded water quality.

The stakes are especially high for coastal estuaries — the nursery grounds for dozens of species of finfish and shellfish and the array of aquatic plant life they rely upon for sustenance and shelter.

Studies show that storm water carries sediment, nutrients, organic materials, bacteria, oil and grease, metals and toxic and synthetic chemicals — posing public health threats, economic losses to commercial fisheries and tourism, and damage to aquatic environments.

Rapidly increasing population growth and development in coastal regions could be a source of even more coastal water quality problems in the future if the prediction holds true that by 2010 nearly half of the U.S. population will live near coastal waters.

Tackling storm water runoff pollution is not just a coastal issue, says Walter Clark, North Carolina Sea Grant coastal law and policy specialist.

Municipalities across the state are working to develop effective storm water management plans to protect water resources in every watershed and river basin.

By 2004, the North Carolina General Assembly is expected to adopt permanent rules for implementing the Phase II Storm Water Program of the U.S. Environmental Protection Agency (EPA), National Pollution Discharge Elimination System (NPDES).

Phase II requires small municipalities and operators of construction sites from one to five acres to implement storm water management plans.

Phase I, governing larger municipalities, has been in place since 1990, Clark explains.

A NATIONAL IMPERATIVE

"Protecting the nation's water quality has been an important element under the umbrella of sustainable development since the passage of the federal Water Pollution Control Act in 1972," says Clark. "Commonly called the Clean Water Act (CWA), this law establishes national standards to protect water quality."

Clark explains that an early goal of the CWA was the development of a permit program to control discharges entering bodies of water through easily identified sources, such as a pipe or a ditch. Since the 1970s, federal and state mandates have targeted these discharges, called point sources, for pollution controls.

Continued

By the late 1980s, attention turned to pollution that enters our waters from more diffuse sources like storm water, snowmelt or atmospheric deposition. In 1987, the CWA was expanded to address nonpoint sources (NPS). These sources remain the focus of today's efforts to protect water quality.

In 1990 EPA established Phase I of its storm water management program to address runoff from "medium" to "large" municipal storm water systems serving populations of 100,000 or greater. It also targets construction activity disturbing five or more acres of land and several categories of industrial activity.

STATE FLEXIBILITY

While the Phase II Storm Water Program is a federal mandate, states have the flexibility to adopt rules to address their particular circumstances, says Greg Jennings, a member of the N.C. Environmental Management Commission and assistant director of the North Carolina Water Resources Research Institute (WRRI).

The state has been operating under a temporary rule since 2002, so local governments and major developers know they will be affected by the permanent rule, Jennings says. Communities and private companies covered under the program must apply for NPDES permits that identify pollution sources and show remedies.

"Roads, ditches and storm drains that collect storm water are considered potential discharge sources that local municipalities will have to address," Jennings explains.

Developers of new residential communities and commercial sites must show how they will manage and treat storm water on site. Shopping center parking lots can't drain directly into a watershed. And, erosion must be contained on construction sites to prevent the flow of sediment in its storm water discharge.

In short, communities and developers will be required to employ best management practices (BMPs) as a systems approach to pollution prevention.

"This is not new to coastal communities," Jennings adds. The 20 counties covered by the Coastal Area Management Act of 1974 are required to develop land-use plans to protect their environmental resources.

With 350 miles of oceanfront land and 4,000 miles of estuarine shoreline, there is no ignoring the fact that land use is tied to water quality. Plans must show measures to control nonpoint source pollution discharges — especially into sensitive shellfish waters.

AHEAD OF THE GAME

Though ahead of the EPA storm water mandate to some degree, cities like Wilmington are especially challenged because of intense downtown development and urban sprawl. Flooding from Hurricanes Bertha and Fran in 1996 underscored the need to deal with storm water.

With that in mind, the Wilmington City Council adopted an aggressive approach to storm water management in 1997, says David Mayes, director of Wilmington's Storm Water Services.

After a year, its citizens advisory committee returned to the council with a litany of work that needed to be done — and a recommendation to adopt a utility fee in 1998 to do the job. Since impervious surfaces create runoff, utility fees are calculated accordingly. Currently, single family residences are assessed $4.75 per month, while other property types pay $4.75 per 2,500 square feet of impervious surface.

Revenue goes to a special fund and is used exclusively for storm water services that include maintenance to the city's storm drainage system and improvement projects, Mayes says.

The fund provides a dedicated source of revenue for drainage projects. Among them is a storm water wetland created at Kerr Avenue to treat runoff from the surrounding

Photo by Bill Hunt

Photo by Barbara Doll

TOP TO BOTTOM:
• Rooftop gardens are among the newer ideas for controlling storm water runoff in urbanized settings. • Big box stores can provide environmentally friendly bioretention areas in parking lots to help filter storm water before it flows into into drainage systems. • This constructed urban wetland at Kerr Avenue in Wilmington drains a 150-acre watershed, filtering pollution from storm water and protecting the nearby tidal creek. • Indivdual homeowners can enhance water quality by planning best management practices into landscape design.

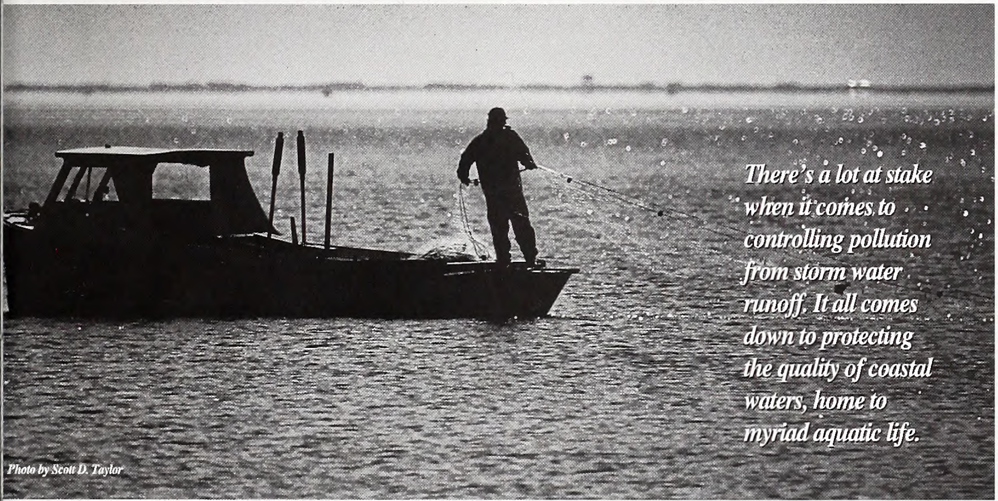
Photo by Scott D. Taylor

Photo by Tracy Skrabal

watershed — a partnership with the state's wetland restoration program. More than 150 acres drain through the .75-acre Kerr Avenue wetland, filtering pollutants and settling sediments that previously washed directly into Burnt Mill Creek.

The project has great visibility — an important outcome. "Education is the key," Mayes says.

Mayes and his colleagues have conducted an impressive public education effort, including quarterly newsletter, *Storm Water Watch*, to present news of ongoing projects. It also informs citizens of ways they can adopt backyard best management practices to enhance their environment. Storm Water Services also offers hands-on school presentations using "Enviroscape," a scaled-down watershed model that demonstrates the connection between storm water runoff and water quality.



There's a lot at stake when it comes to controlling pollution from storm water runoff. It all comes down to protecting the quality of coastal waters, home to myriad aquatic life.

Photo by Scott D. Taylor

RESEARCH LINKS

Wilmington's collaboration with the University of North Carolina at Wilmington is an important factor in the storm water planning process, Mayes says. Through the Tidal Creeks Program and the Watersheds Project, city and county officials and citizens keep abreast of researchers' water quality studies. Now, city and county officials are working to adopt universal development regulations that take into account storm water management strategies.

Some area builders and developers included in discussions are attempting to create "green" communities.

The developer of Hewlett's Run redesigned plans for a 16-acre site. He scrapped the traditional tract pattern, opting to cluster homes to preserve upland wetlands that protect Hewlett's Creek from storm water runoff.

Does it work? UNC-W's Larry Cahoon believes so. "This developer maximized vegetation and minimized clearing before the first house was built. He used pervious pavement wherever possible," recalls Cahoon, a Sea Grant researcher.

The builder also directed the runoff away from the stream and into the natural wetland. Homes are tucked into naturally vegetated settings. Lawns are kept to the minimum to cut down on nutrient loading from fertilizers.

Cahoon gives the developer high grades for controlling runoff and sediment. "If you manage sediment, you manage storm water. If sediment is loose, so is everything else, including nutrients, coliform, etc," he concludes.

HELP FOR COMMUNITIES

Mayes says no community has to "go it alone" to implement Phase II. There are resources from Sea Grant, universities, river watch programs, the N.C. Coastal Federation, and a long list of state agencies that offer technical assistance.

Soon, North Carolina Sea Grant will have one more resource to help coastal communities and developers implement the EPA Phase II guidelines and ongoing CAMA land-use planning, Clark says.

Sea Grant has received funding from the state's Division of Water Quality to create a new staff position.

Likely to be based at the Center for Marine Sciences and Technology at Morehead City, the new Sea Grant specialist will work with Clark to consult with local governments and citizens. The position, Clark adds, can be an important link between communities and university and state agency experts. Some educational efforts would include helping to develop low-impact and open-space design strategies to improve water quality and achieve sustainable development goals.

"Finding the balance between growth and environmental protection is a quest that is likely to keep legislators and resource managers busy well into the foreseeable future," Clark concludes. ▣

HELPFUL RESOURCES

- EPA Storm Water Phase II Fact Sheets and Model Ordinance: *www.epa.gov/npdes/stormwater* and *www.epa.gov/owow/nps/ordinance*
- North Carolina State University Water Quality Group: *www.ncsu.edu/waterquality*
- N.C. Division of Water Quality: *http://h2o.enr.state.nc.us/*
- Water Resources Research Insitute: *www2.ncsu.edu/ncsu/CIL/WRRI/*
- North Carolina Sea Grant: *Soundfront Series*: *Protecting Estuarine Water Quality by Design,* by Nancy White; *Protecting the Estuarine Region Through Policy and Management,* by Walter Clark. To order, call 919/515-9101.

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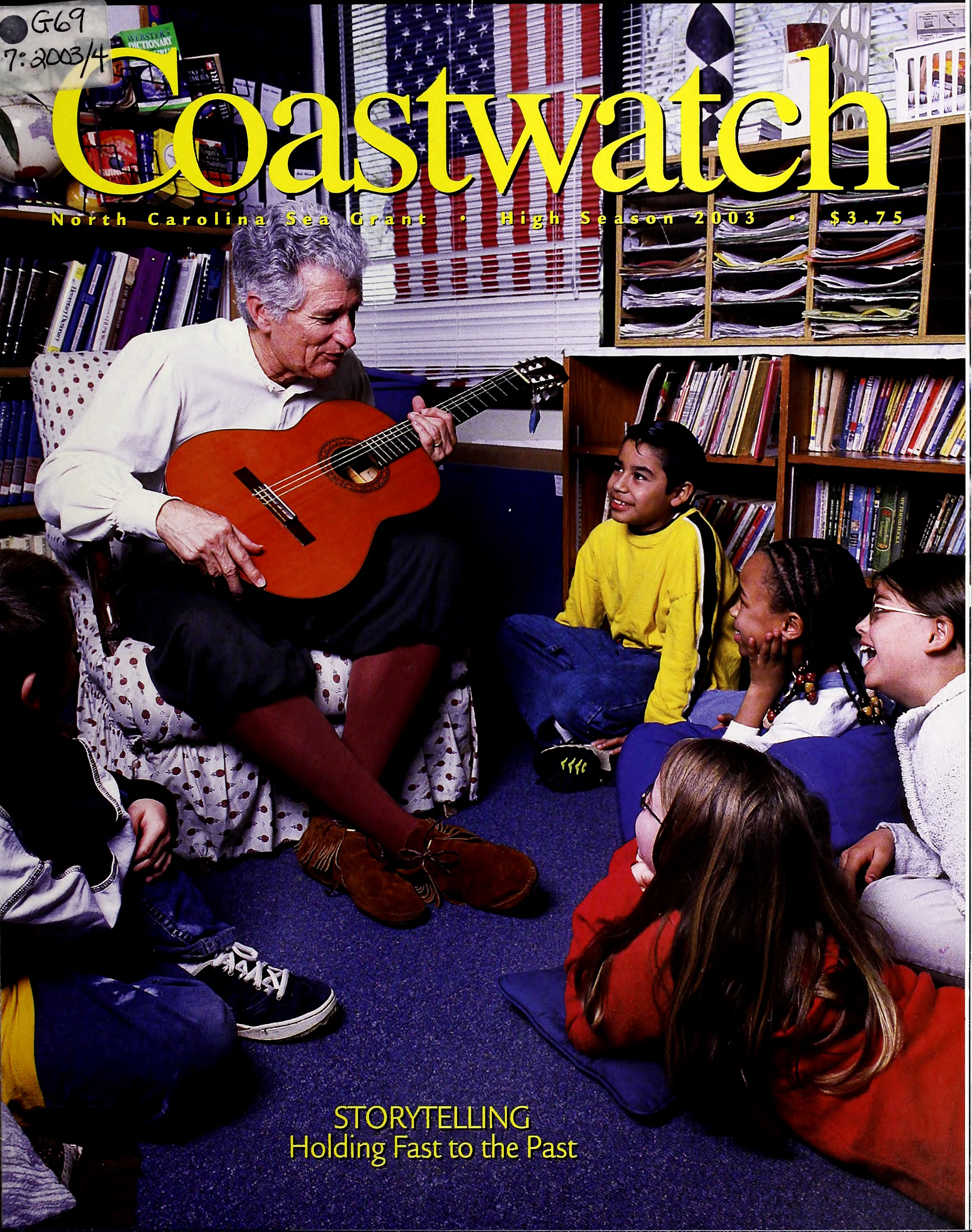

STORYTELLING
Holding Fast to the Past

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Summer School

Herman Lankford

Watch out Wilmington, the energy level is about to escalate as the National Marine Educators Association takes the coast by storm.

Hundreds of educators — from schools, libraries, aquariums, museums, parks, universities, etc. — will be in town July 20-24 for the group's annual meeting. This year, conference organizers are extending a special invitation to home-school parents looking for creative curricula.

NMEA members are the folks who get kids of all ages excited about the unique plants and animals found in coastal and marine ecosystems. You can imagine just how packed the schedule will be — more than 150 concurrent sessions with themes such as climate and weather, technology in ocean sciences education, elementary education and maritime heritage. Yes, they teach about people, too.

And, you can't keep them in their seats. Field trips range from scuba diving at shipwrecks to fossil hunting on shore, and from helping out at the turtle hospital to exploring undeveloped Masonboro Island.

North Carolina Sea Grant, along with the National Sea Grant College Program and other state programs in the region, are among the many sponsors of the event. Look for the Sea Grant exhibit and stop to say hello.

To find out more about the conference, including single-day registration, go online to *www.marine-ed.org/nmea2003*. Or, check with co-chairs: Andy Wood of North Carolina Audubon, 910/798-8376, *awood@audubon.org*; or Terri Kirby Hathaway of the N.C. Aquarium at Roanoke Island, 252/473-3494, x227, *terri.hathaway@ncmail.net.*

Terri and Andy represent two of the many agencies and organizations that have marine educators on staff, providing a wide range of public programs along our coast.

Visitors to the coast should take advantage of these educational opportunities alongside the rest and relaxation, wading adventures and elaborate sandcastles, beach novels and afternoon naps that fill days at the beach. And, coastal residents can find out more about their own backyard through seminars and workshops — some at the facilities, others in the field, marsh, surf, etc.

All three of the aquariums — Fort Fisher, Pine Knoll Shores and Roanoke Island — offer a variety of programs, as do the National Estuarine Research Reserves, the N.C. Maritime Museum, state parks, national seashores and the national wildlife refuges.

Also check the schedules of nonprofit groups, such as Partnership for the Sounds, the N.C. Coastal Federation and the Nature Conservancy, just to name a few.

Ask locals about hidden treasures, and they may tell you about the Missiles and More Museum, located in the Assembly Building in Topsail Beach. Displays relate the role Topsail Island played in the development and early testing of missiles and jet aircraft. The "more" topics include a display of sharks' teeth that can be found on the island's shoreline.

In more than 15 years of visiting North Carolina beaches, I have always found Topsail to have a plentiful supply of sharks' teeth. Thus a few years back I was happy to take home the museum's simple brochure that identifies various teeth by size, shape and respective species.

Much like the sea beans described in this issue, sharks' teeth provide "teachable moments" alongside the thrill of finding a coastal treasure.

Katie Mosher, Managing Editor

IN THIS ISSUE

Contributing Writers:

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Katie Mosher ▫ Julie Powers ▫ Pam Smith

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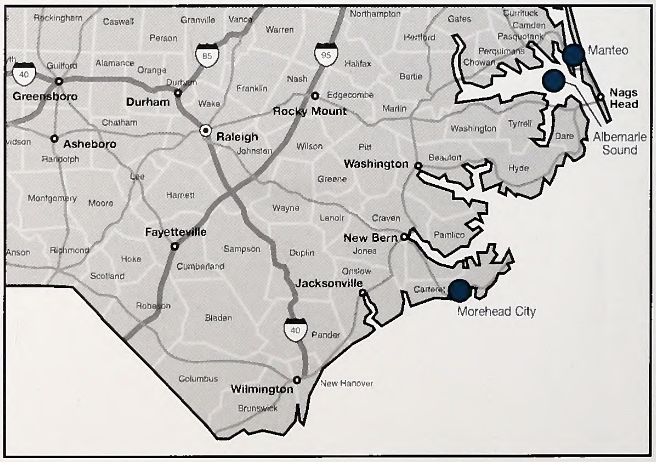
Melissa McGaw ▫ Matt Parker ▫ Edward L. Perry
Pam Smith ▫ Scott D. Taylor

North Carolina's diverse coast offers countless interesting subjects. The large dots on the locator map indicate story settings in this issue — including Manteo, the Albemarle Sound and Carteret County.



Coastwatch

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FEATURES

COASTAL TIDINGS 2

COASTAL STORYTELLERS SPIN FISH HOUSE TALES AND OTHER WHOPPERS

Across the North Carolina coast, storytelling styles vary. Ann Green introduces readers to some coastal storytellers who pass down tales from one generation to the next. *On the cover: Cooper Elementary students in Clayton, clockwise from top right, Francisco Islas, Kayla Edwards, Michaela Suarez, Sarah Maynard and Ethan Book enjoy songs and stories by John Golden.* **6**

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Coastwatch

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The North Carolina Sea Grant College Program is a federal/state program that promotes the wise use of our coastal and marine resources through research, extension and education. It joined the National Sea Grant College Network in 1970 as an institutional program. Six years later, it was designated a Sea Grant College. Today, North Carolina Sea Grant supports several research projects, a 15-member extension program and a communications staff. Ron Hodson is director. The program is funded by the U.S. Department of Commerce's National Oceanic and Atmospheric Administration and the state through the University of North Carolina.
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Front cover photo of John Golden and students by Melissa McGaw. Table of Contents photo of crabs by Scott D. Taylor. Printed on recycled paper.

COASTAL TIDINGS

Nash Takes Triple Honors

Photo by Scott D. Taylor

Barry Nash doesn't make seafood, he makes it better by working with seafood processors to develop new or value-added products, conducting seafood safety education workshops, and responding to concerns from consumers.

Nash, North Carolina Sea Grant seafood technology and marketing specialist, earned triple honors at North Carolina State University for his efforts.

He received an Outstanding Extension Service Award from the university. He was cited for "demonstrated achievements in serving the people of North Carolina" and was inducted into the Academy of Outstanding Faculty Engaged in Extension.

In addition, Nash received the 2003 Alumni Outstanding Extension and Outreach Award, presented by the NC State Alumni Association. Along with receiving a monetary award, Nash was recognized for his accomplishments during the 2003 Honors Baccalaureate and an Alumni Association Awards Dinner.

He also received the 2003 Research and Graduate Studies' Award for Excellence, presented by NC State Human Resources. The awards program recognizes employees' day-to-day contributions to the university and the citizens of the state.

Nash joined the North Carolina Sea Grant Marine Extension Program in 1998. He is stationed at the NC State Seafood Laboratory located at the Center for Marine Sciences and Technology (CMAST) in Morehead City.

Nash collaborates with other Sea Grant and Cooperative Extension personnel at CMAST, the state and the nation. – P.S.

Photo by Matt Parker

Oysters Put on Show

They may not make *American Idol*, but oysters at the Sea Grant hatchery have achieved celebrity status in their own right.

Skip Kemp, North Carolina Sea Grant mariculture and marketing specialist, welcomed media to observe the first spawning of oysters in his restoration research project. Greenville's WNCT Channel 9 TV News, the *Carteret County News-Times* and the *Jacksonville Daily News* were on hand for the event.

But sixth and seventh graders from Carteret Academy touring the hatchery got the best "show" after the TV cameras were gone.

Kemp missed seeing the TV coverage. He was busy tending oyster spawners. *Coastwatch* will follow the progress of the restoration project he is conducting in collaboration with Carteret Community College. Look for details in a future issue. – P.S.

In the Next Issue of *Coastwatch*

Veteran seafood cooks and novices await the fall release of *Mariner's Menu: 30 Years of Fresh Seafood Ideas*. Sarah Friday Peters takes *Coastwatch* readers behind the scenes to meet author Joyce Taylor and the dedicated corps of Nutrition Leaders. And Ann Green visits the last beach seine operation for striped mullet in Carteret County.

Counting Horseshoe Crabs For Research

Photo by courtesy of NOAA

A sunset walk on the beach may be romantic for some. But for volunteers at the Rachel Carson Estuarine Research Reserve, it's an opportunity to be part of a scientific study of horseshoe crabs.

Researchers at the reserve are teaming up with the N.C. Division of Marine Fisheries to establish a monitoring program that aims to determine where spawning populations lay their eggs. The information is an important step in developing a management plan for this declining fishery.

Volunteers and reserve staff count horseshoe crabs during beach walks daily just after sunset and when tides are high through the end of July. That's when horseshoe crabs come ashore to spawn. Females bury themselves into sand and release thousands of eggs to be fertilized by attending males.

Scientists say horseshoe crab populations are down throughout their range — from Maine to the Yucatan Peninsula. The prehistoric-looking creatures have been used for fertilizer, animal feed and bait since the 1800s. In recent years, blood from horseshoe crabs has been harvested for human pharmacological applications.

Interested volunteers can contact Whitney Kurz at 252/728-2170 or *whitney_kurz@ncerr.org.*

– P.S.

Planting Marsh Grass with Pit Crew Speed

Photo by Cheryl Burke, Carteret County News-Times

Kathy McEvoy led a team of volunteers to plant marsh grass.

In what could be some kind of horticultural record, about 20 volunteers planted 750 marsh grass seedlings in just 75 minutes.

The volunteers from the N.C. Coastal Federation were completing a shoreline restoration project at Duke University Marine Laboratory on Piver's Island.

Natural erosion-control methods were used for the 23,000-square-foot restoration project that included the removal of a 260-foot sea wall. The design included a rock revetment and planted berm to reduce erosion and contain contaminated stormwater runoff.

The work was funded by a grant from the National Oceanic and Atmospheric Administration.

In all, 7,000 seedlings were planted, most of them a year ago. The recent planting marathon, headed up by the federation's Kathy McEvoy, was considered "filling in" spots where some die-off occurred.

The N.C. Coastal Federation has nearly 20 demonstration projects along the coast, including several alternatives to bulkhead sites designed in collaboration with North Carolina Sea Grant.

– P.S.

Photo by courtesy of NOAA

Be Prepared: Stormy Weather Ahead

Hurricane season will be taking the Atlantic, Gulf and Caribbean coastal areas by storm if all goes as predicted for 2003.

The season, June 1 to Nov. 30, has the potential for high levels of hurricane activity, according to the National Oceanic and Atmospheric Administration's 2003 Atlantic Hurricane Season Outlook.

Expected weather conditions, including La Niña, have contributed to the outlook's estimate of 11 to 15 named tropical storms – six to nine of those becoming hurricanes, with two to four being classified as major hurricanes.

With such a high risk for dangerous weather patterns, NOAA has focused on improved forecasting as a preventative measure.

Data gathered by NOAA's newest Gulfstream-IV hurricane surveillance jet has equipped forecasters with the ability to create five-day storm forecasts that are equal in accuracy to the three-day forecasts of the past.

"This five-day forecast provides a valuable planning and preparedness tool and is a tangible step forward in our efforts to protect lives and property, and enhance the U.S. economy," said James R. Mahoney, NOAA deputy administrator.

The forecasts will be especially useful to those needing additional time to move or make arrangements for people and resources.

– L.L.

How are We Doing?

As part of the National Sea Grant Program network, North Carolina Sea Grant will have a national team of experts on hand in September to evaluate research, education and outreach programs.

The team will include two members of the National Sea Grant Review Panel, a director from another Sea Grant program and experts in coastal topics.

The group will visit coastal locations to meet with constituent groups served by Sea Grant. The panel also will hear presentations by Sea Grant-funded researchers from the University of North Carolina system, and will meet with advisory council members and others.

The review team requests comments from North Carolina residents regarding the role of North Carolina Sea Grant, with an emphasis on Sea Grant activities within the past five years.

Written comments are due by Aug.15. Send to: Peter Bell, Chair, c/o Ronald G. Hodson, North Carolina Sea Grant, NC State University, Campus Box 8605, Raleigh, NC 27695-8605. – K.M.

Sea Grant on the Move

North Carolina Sea Grant's Manteo office has moved to 217 Budleigh St. in downtown Manteo.

The former county office building also will be home to the newly created University of North Carolina Coastal Studies Institute on Roanoke Island. Interim Institute Director Nancy White will be onboard this month.

Ann Pierce will double as administrative assistant for Sea Grant and the institute. To contact them, mail to P.O. Box 699, Manteo, NC 27954; phone: 252/475-3663; fax: 252/475-3545.

Jack Thigpen, Sea Grant extension director and tourism specialist, is relocating to Sea Grant's headquarters at North Carolina State University. To reach him, mail to North Carolina Sea Grant, NC State University, Box 8605, Raleigh, NC 27695-8605; phone 919/515-2454. – P.S.

White to Lead New Program

Photo by Pam Smith

Nancy White has been named interim director of the newly established University of North Carolina Coastal Studies Institute on Roanoke Island.

White's initial task will be to lay the foundation for the center that will focus on the unique history, culture, environment and maritime counties of northeastern North Carolina.

She brings to the position a wealth of community-building experience. Until her appointment, White was a research associate professor and extension specialist in the landscape architecture department at the North Carolina State University College of Design. She also served as extension program leader and director of research, extension and sponsored programs for the college.

White has earned recognition across the state and nation for her work in landscape ecology. Her research and education focus is on the relationship of land-use change, watershed hydrology, bacterial contamination and water quality.

In recent years, she has received more than $4 million in federal and state grants to test techniques for more sustainable land use and site design — particularly as they relate to fecal coliform mitigation. The results of her studies have been published in professional journals, including the *Journal of Shellfish Research.*

White frequently collaborates with North Carolina Sea Grant on mitigation projects and on publications. She authored *Protecting Estuarine Water Quality Through Design* (UNC-SG-01-13), one of four informational guides in *The Soundfront Series.*

The institute office is at 217 Budleigh St. in downtown Manteo. – P.S.

McLellan Receives NOAA Hero Award

Photo courtesy of UNC-W

William A. McLellan receives a 'heroes welcome' during UNC-W Earth Day celebrations

William A. McLellan, a University of North Carolina at Wilmington Center for Marine Science researcher, has been honored as a 2003 NOAA Environmental Hero by the National Oceanic & Atmospheric Administration.

McLellan was presented the award in April at an Earth Day celebration at UNC-W.

The award recognizes McLellan for his outstanding efforts over 18 years, responding to and investigating marine mammal strandings throughout the nation. He has volunteered numerous hours and driven thousands of miles to determine the causes of strandings. McLellan responded to die-offs in 1998 on the West Coast and in 1994 in Texas.

Now, McLellan is the large whale necropsy team leader for the mid-Atlantic, as well as the North Carolina stranding coordinator.

The NOAA Hero award, established in 1995 to commemorate the 25th anniversary of Earth Day, honors individuals and organizations for their "tireless efforts to preserve and protect our nation's environment." – A.G.

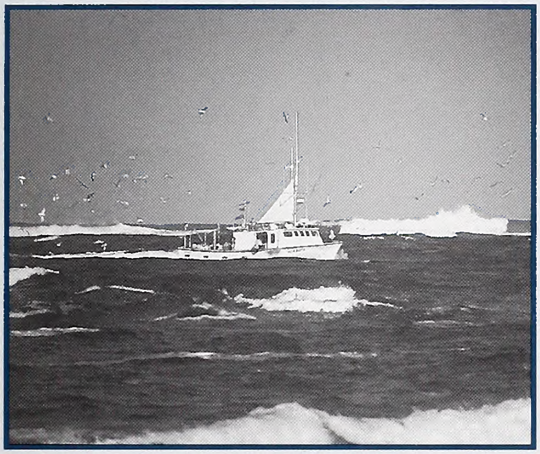


Photo by Scott D. Taylor

Oregon Inlet Jetty Project Called Off

Federal agencies will not proceed with the proposed Oregon Inlet navigational plan that included building giant rock jetties on both sides of the inlet.

By discontinuing the project, the White House Council on Environmental Quality, the U.S. Army Corps of Engineers and the Interior and Commerce departments expect to resolve a 30-year controversy over the jetty project.

Instead of the jetties, the Corps will improve the current 14-foot navigational channel. The Corps also will work with the National Oceanic and Atmospheric Administration (NOAA) to enhance boat safety by providing more up-to-date navigational data on changing sand conditions in the channel.

In 1970, Congress authorized the project that included the Corps dredging the 20-foot by 400-foot navigation channel to accommodate deep-draft fishing boats and construction of two large jetties to divert sand from the channel.

Oregon Inlet is the only barrier island break in the northern part of the Outer Banks, providing access for boats between the Atlantic Ocean and the Albemarle-Pamlico Sound. The project was supported by the commercial fishing community but opposed by some environmental groups and government agencies.

Over the past three decades, the Corps has conducted numerous economic and environmental analyses under the National Environmental Policy Act. NOAA opposed the project because of a potentially significant impact on the area's already diminished fisheries.

In addition, two Interior Department agencies — the National Park Service and U.S. Fish and Wildlife Service — expressed concern over potential erosion of the Cape Hatteras National Seashore and the Pea Island National Wildlife Refuge. — A.G.

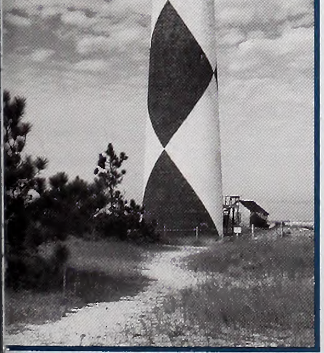


Photo by Scott D. Taylor

Cape Lookout Lighthouse Gets New Owner

For years, the U.S. Coast Guard kept the lights bright at the Cape Lookout Lighthouse.

In June, the lighthouse got a new caretaker — and a new stamp from the U.S. Postal Service.

During a ceremony, the ownership of the lighthouse was transferred from the Coast Guard to the National Park Service.

"This will be more than a transfer of ownership from one government agency to another," says Cape Lookout National Park superintendent Bob Vogel. "The Coast Guard has taken good care of the lighthouse. Now, we want to restore it and make it available for generations to come."

A nonprofit group called the Friends of Cape Lookout National Seashore has been formed to support the park service's effort to preserve the lighthouse.

The lighthouse will be administered as part of Cape Lookout National Seashore that stretches over 56 miles of coastline along North Carolina's Outer Banks. For more information about the lighthouse, call 252/728-2250 or visit the Web at *www.nps.gov/calo.* — A.G.

Photo by Scott D. Taylor

Blue Crabs Lead N.C. Commercial Species in 2002

The North Carolina fishing community brought more seafood to the docks in 2002, but made fewer trips to catch finfish, crabs, shrimp and shellfish, according to the N.C. Division of Marine Fisheries (DMF).

Commercial fishers landed 160 million pounds of fish and shellfish at Tar Heel docks, with the catch valued at $94.6 million. Total landings were up 22.9 million pounds from 2001, but fell slightly below the previous five-year average of 170 million pounds. The top commercial species was blue crabs — valued at $29.3 million — followed by shrimp at $18.3 million.

Blue crab landings increased by 6 million pounds from 2001, but they continue to be well below the 47.8 million-pound average for the previous five years. The largest increase was in the Albemarle Sound, while crab landings for the rest of the state remained unchanged from previous years.

The total seafood catch increased in 2002. But effort dropped by 31,024 fishing trips. The bulk of the decline came from the blue crab fishery, which fell by 15,000 trips from the previous year.

To find out more about the 2002 harvest figures, visit the DMF Web site: *www.ncfisheries.net* at 252/726-7021. — A.G.

Photo by Scott D. Taylor

Coastal Storytellers Spin Fish House Tales and Other Whoppers

By Ann Green

LEFT: Rodney Kemp is preserving Carteret County's fine art of fish house lying.

Photo by Scott D. Taylor

Photo by Scott D. Taylor

TOP: From left, James Allen Rose, Kitty West, Newport Mayor Derryl Garner, David Yeomans, Rodney Kemp and Capt. Jim Willis entertain the audience at the 2003 Storytelling Festival in Morehead City. BOTTOM: Bland Simpson, director of the Creative Writing Program at the University of North Carolina at Chapel Hill, shares some of his unique coastal stories.

While standing in front of a fish house scene complete with rocking chairs, Rodney Kemp spins a whopper about a bolt of lightning turning North Carolina's only menhaden plant into a towering inferno.

The Beaufort Fisheries management called in fire trucks from all over Eastern North Carolina and as far away as Raleigh, says Kemp.

"Those fire trucks couldn't get within 100 feet of the fire because of intense heat and watched it burn," relates Kemp to an audience at the 2003 Down East Storytelling Festival in Morehead City. "So finally the management of Beaufort Fisheries waved a check for $10,000 as a reward to the firefighting company that is successful in putting out the blaze."

But not a single fire truck budged, he says.

Continued

After a caboose dislodged, conductor Joe Baldwin waved
As the train plowed into the dislodged caboose, it decapi

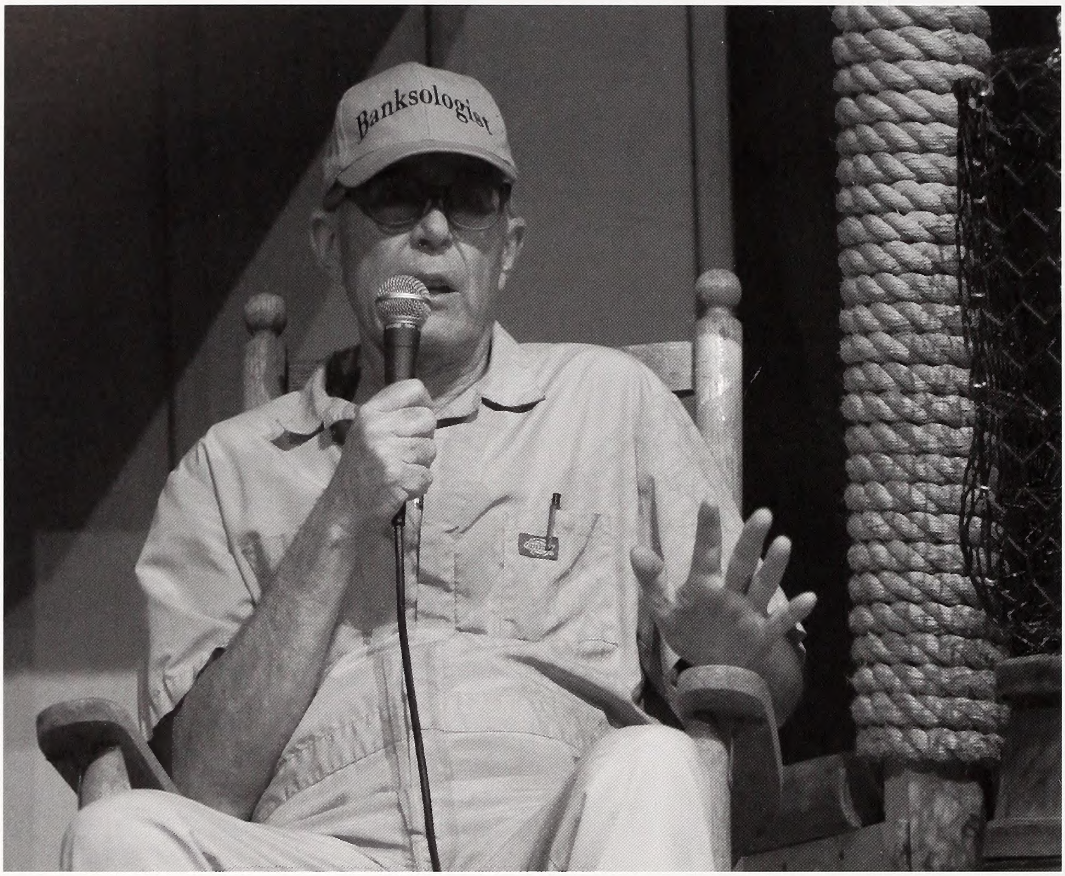


Photo by Scott D. Taylor

ABOVE: Capt. Jim Willis, who calls himself a "Banksologist" to honor his love of the barrier islands, has been telling stories since he was a young boy.

"Suddenly, they heard a great commotion and turned just in time to see full bore — coming down Front Street — none other than the Cedar Island Fire Department," adds Kemp. "Now the Cedar Island Fire Department was driving a 1952 double pumper." With two buckets of sand, two ladders and three buckets of water they put out the blaze.

When asked what he would do with all the money, the first thing the chief said was to take the old truck and fix them brakes, Kemp adds.

As one of the original "fish house liars," Kemp has told the "Cedar Island Fire Department" tale dozens of times.

"When you start telling stories like I do — and people halfway believe you — they give you a label, a term of endearment," he says. "People started calling me a common fish house liar."

A group of about eight men started telling tall and dubious tales around 1991 and were dubbed fish house liars by master storyteller Josiah Bailey. Today, Kemp and Sonny Williamson of Marshallberg still are spinning tales in Carteret County.

"The tales we tell as liars are the same stories which have been passed down verbally from generation to generation," Williamson writes in *Fish House Lies.* "Over the years, they have been added to, modernized and changed until the only truth remaining is that they are intended strictly for entertainment and, even though we sometimes poke fun, it is never done with malice. This is important to remember because that's what it's all about, to just have good, clean fun."

Varied Styles

Although both Kemp and Williamson are fish house liars, their styles differ. Williamson has a Down East storytelling style in comparison to Kemp's "Southern style" that is similar to the late comedian Jerry Clower and the late newspaper columnist Lewis Grizzard, says Kemp.

Across North Carolina, there are many storytelling styles.

"Every region is different," says Kemp. "People Down East in Carteret County don't understand mountain Jack tales."

However, Down Easters do have a gift for telling stories, according to North Carolina State University professor Carmine Prioli, who wrote *Hope for a Good Season: The Ca'e Bankers of Harkers Island.* "They all have natural instincts for storytelling," says Prioli. "When they get on a roll, there is no stopping them."

For years, Capt. Jim Willis of Salter Path has been telling Down East stories.

Dressed in a khaki jumpsuit and fishing cap, Willis calls himself a "Banksologist" because he studies the Outer Banks and specializes in the Bogue Banks that includes Atlantic Beach and Salter Path.

"True Banks tales don't have no name," says Willis. "I have broke with tradition and give my stories names. I studied at the University of Salter Path under Dr. Little George Smith and Professor Bryant Guthrie of the Promise' Land."

A five-block area in Morehead City is dubbed the Promise' Land by those who migrated from Ca'e Banks, where the Cape Lookout Lighthouse stands.

Willis uses the Banks brogue when telling tales, including "Unquenchable Thirst" about a Banker who loved any kind of whiskey.

Storytellers in Carteret County spin many stories about alcohol.

a light at an approaching freight train.
ted the conductor's head.

In the shade of weeping willows in front of his Core Banks cottage, David Yeomans often entertains tourists by crooning "The Booze Yacht" — a ballard about a whiskey boat gone aground.

"I learned this from my father who was a storyteller," says Yeomans. "He wrote some things and told stories sometimes. He would tell stories at fish houses."

Coastal Legends

Along the coast, storytellers also entertain audiences with ghost, pirate, hunting and Indian stories.

One popular tale is "Maco Light," set in 1867 in Maco — about 15 miles outside of Wilmington in Brunswick County. After a caboose dislodged, conductor Joe Baldwin waved a light at an approaching freight train, according to *North Carolina Legends,* edited by Richard Walser. As the train plowed into the dislodged caboose, it decapitated the conductor's head.

Photo by Scott D. Taylor

ABOVE: Newport Mayor Derryl Garner spins a historical tale about the days when Quakers first settled in Newport.

"Thereafter on misty nights, Joe's headless ghost appeared at Maco," the legend goes. During an 1899 campaign trip, President Grover Cleveland reported seeing the light — and so have hundreds of people through the years. But in 1977, the railroad tracks were removed and the swamp reclaimed the haunting grounds. "Joe seems to have lost interest in Maco. At least he has not been there lately," the legend ends.

On Ocracoke Island, stories of Edward Teach — also known as Blackbeard the Pirate — abound. They include "The Pirate Lights of Pamlico Sound" in Charles Harry Whedbee's *Legends of the Outer Banks and Tar Heel Tidewater.*

While on his ship the *Queen Anne's Revenge*, Blackbeard shot and crippled his mate, Israel Hands, at Teach's Hole.

Later, he battled the British while aboard another ship. Toward the end of the fight, a British sailor killed Blackbeard and cut off his head, according to the legend.

"To this day at Ocracoke, some will tell you that the 'Teach lights' are still seen on occasion both over and in the waters of Pamlico Sound," writes Whedbee. Blackbeard's ghostly ship is sometimes seen in the light of the waning moon. Some say the headless figure of Blackbeard can been seen in the dark of the moon as the body swims around and around Teach's Hole, searching for its severed head."

Storytelling History

Throughout coastal North Carolina, storytelling has become an art form.

Years ago, people gathered at country stores, fish houses and front porches to exchange tales. One popular spot on Harkers Island was Cleveland Davis' store called "the beehive."

One storyteller, Grayden Paul of Beaufort, earned a reputation for his innate ability to relate tall tales.

"Grayden Paul was the best storyteller I ever heard," says Kemp. "He performed in the 1940s, '50s, '60s and '70s. He had a regular routine and amazing stories."

Today, people tell stories at festivals and family reunions.

"I love storytelling," says musician and storyteller Connie Mason. "People are hungry for it with e-mail and electronic devices.

Continued

The squirrel was pushing bark back into the water. Wh
pushed its tail up, and the wind blew it across the wate

Photo by Scott D. Taylor

ABOVE: Harkers Island native James Allen Rose, who is also well known for making model boats, has a unique style of storytelling.

Storytelling is personalized."

For Ocracoke storyteller Donald Davis — who has performed all over the world, including the Smithsonian Institution — storytelling is a "way of giving and living life."

"He invites each listener to come along, to pull deep inside for one's own stories, to personally share and cocreate the common experiences that celebrate the creative spirit," Davis recounts on his Web site.

In a few small communities, residents also spin yarns at restaurants and other hangouts.

Each morning, a group of men gather at a round table and tell tales at the Heritage House in Windsor.

"Most of the time the men tell stories about farming, fishing and hunting, and how things were a long time ago," says Rachel Pierce, the restaurant's co-owner. "Some come as early in the morning as 5:30. They have been friends forever, and all are retired and natives of Bertie County."

Liars Club

In the tiny community of Powellsville near Ahoskie, members of the Scrub Club — which is made up of about 20 retired men — swap tales every weekday at a closed gasoline station on N.C. 42.

"Everybody tries to top somebody else," says Buck Carter, the club's treasurer. "You tell the biggest lie you can think of. Others are supposed to tell a lie bigger than yours so people will believe it."

One of Carter's favorite lies is about a squirrel that he saw while hunting.

"The squirrel was pushing bark back into the water," he says. "When the squirrel got to the water, it jumped in, pushed its tail up, and the wind blew it across the water. Then it jumped up the tree on the other side."

After Carter told the tale, another man topped the story.

To keep the group from disbanding, members have to follow a few rules. "We don't allow anyone who works," says Carter. "It is a bad influence. We don't talk politics or religions. We don't want to have a falling out."

Although storytelling offers local folks a quaint form of entertainment and an interesting pastime, it also links them to their past, according to Jack Thigpen, North Carolina Sea Grant extension director and coastal and tourism specialist.

"These stories also give a glimpse into a region's culture and history," says Thigpen. "Often important moral values and shared virtues are interwoven with humor."

What makes a good storyteller?

Whether spinning fish tales or historical vignettes, a good storyteller believes in what he is doing and enjoys it, says John Golden of Wilmington.

"Beyond that, the sky is the limit," he says. "I am continually developing different ways of telling a story — from sitting in a chair for a classical tale to a living history performance of folklore and legends."

n the squirrel got to the water, it jumped in,
Then it jumped up the tree on the other side.

Photo by Scott D. Taylor

ABOVE: Rodney Kemp joins David Yeomans as he croons "The Booze Yacht." Yeomans often spins stories for tourists who stop at his cottage on Cape Lookout National Seashore.

School Performance

For a group of students at Cooper Elementary School in Clayton, Golden dressed like an Elizabethan sailor in a white belted shirt, olive green breeches and tan moccasins.

"I am a minstrel bringing news from 400 years ago from Queen Elizabeth's court," he says.

"Queen Elizabeth never married, and men were coming to her court to impress her," says Golden. "She was the most powerful woman in the world and had a great armada of ships."

Golden asks the students to sing "Froggy Went A-Courting" with him. Later, he engages the students with bean games and more tales about Sir Walter Raleigh's voyage to the New World.

At the end of the performance, Golden strums his guitar while singing "Virginia Dare."

"I wrote these words to tell the sad story of the mysterious fate of the little girl to go along with the beautiful melody composed by my songwriting partner, Rob Nathanson," he says.

Ann White, fourth grade teacher, says that the historical tale was perfect for her students who are learning North Carolina history.

"They have heard the legend of 'Virginia Dare the White Doe,' " says White. "This is a good culminating activity. For the fifth graders, it reinforces what they have learned. It gives the third graders a good introduction to our state's history."

For younger students, Golden relates less serious subjects like animal tales. "I tailor my stories to the audience," says Golden.

Sound Country Stories

When spinning yarns about the coastal plains, Chapel Hill author and musician Bland Simpson draws on his roots in Pasquotank County.

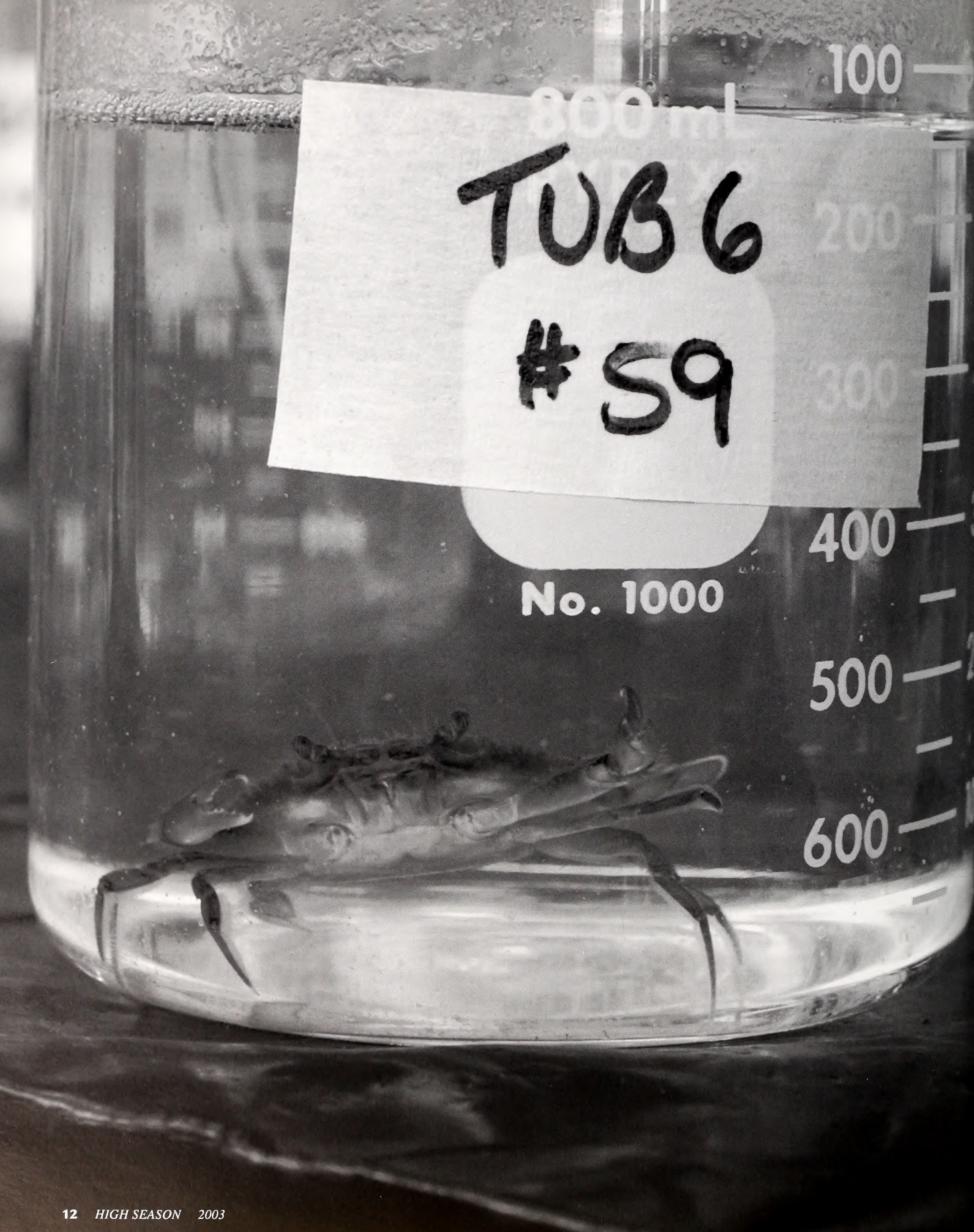
"I learned stories from my father who was a lawyer and a good yarn spinner and also in the Merchant Marine and Navy," says Simpson, a member of the Red Clay Ramblers.

In the book *Into the Sound Country: A Carolinian's Coastal Plain*, Simpson relates childhood memories, including that of his father "coming home at breakfast time with a brace of ducks from his first-light Currituck hunts."

His stories and songs also draw inspiration from North Carolinian John Harden's *The Devil's Tramping Ground and Other North Carolina Mystery Stories* and Nell Wise Wechter's *Taffy of Torpedo Junction*.

These books were Simpson's and his schoolmates' "first literary inklings that real and noteworthy things of history — and mystery — had occurred right in the small towns and country crossroads where we lived, and that the telling and retelling of these stories in classrooms and living room were no small part of what bound us together as Tar Heels, as Southerners, and as Americans," Simpson wrote in the foreward to the 1996 reissue of *Taffy*. ◘

Want to hear more coastal tales? Rodney Kemp and Sonny Williamson will perform together on Oct. 4 at noon at the 17th Annual N.C. Seafood Festival in Morehead City. For more information, visit the Web: www.ncseafoodfestival.org.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Blue Crab Lab

A RECIPE FOR SURVIVAL

By Cynthia Henderson • Photographs by Michael Halminski

ABOVE: Murray Bridges of Endurance Seafood is a veteran crabber who supplies sponge crabs for the hatchery project. Here, he is gearing up for the soft-shell season.

LEFT: Here is "Number 59" from the 2002 batch of blue crabs grown at the N.C. Aquarium on Roanoke Island as part of the N.C. Blue Crab Research Program.

Before it lives up to its scientific name — *Callinectes sapidus* or tasty, beautiful swimmer — the blue crab goes through a couple of ugly larval stages. Fortunately, its survival doesn't depend on its being a beautiful baby.

Equally fortunate is the fact that Joanne Harcke, conservation and research coordinator for the North Carolina Aquarium on Roanoke Island, finds the ugly stages fascinating if not, in their own way, beautiful.

In a project funded by the North Carolina Blue Crab Research Program, Harcke focuses on raising blue crabs from eggs through larval stages. Ultimately, she hopes to develop procedures for growing blue crabs in hatcheries to help replenish wild stocks.

The Blue Crab Research Program is funded by the General Assembly and administered by North Carolina Sea Grant to address problems facing the blue crab industry — the largest of the state's commercial fisheries. Some scientists are concerned that a drop in crab harvests in recent years may signal a decline in the species.

Stock enhancement research such as Harcke's is relatively new with blue crabs. The University of Maryland and the Smithsonian Environmental Research Center report success in growing crabs for the same purpose. And, Harcke says, stock enhancement has been tried in Japan with another species of crab, *Portunis trituberculatus*, which is a swimming crab like *Callinectes sapidus*.

But until now, techniques for growing blue crabs have been elusive. Mortality is high, especially when the animals molt, or lose their shells — as frequently as every five days in the early stages. And once crabs reach a certain stage of development, they have a nasty habit, in captivity or under crowded conditions, of eating each other.

Harcke gets sponge crabs — females bearing eggs — from local crabbers and takes the crabs into her lab at the aquarium. When fertilized eggs hatch, they become larvae called zoea. Viewed under a microscope, they look like something that might be controlled by spraying, with sharp thorn-like structures between their eyes and on their backs.

After seven or eight molts, the zoea become megalopae, which are more shrimp-like in appearance.

Harcke's goal is to find replicable ways to grow crabs to the megalops stage — just before they turn cannibalistic — so they could be released to the wild. However, in the lab, she has made tiny isolation chambers from short lengths of PVC pipe with screen mesh bottoms to protect juvenile crabs from each other until they reach adulthood.

Hatching and growing crabs is just the first, and still theoretical, step in stock enhancement. Once released, there is the question, not only of whether stock enhancement will work, but also how to tell if it works.

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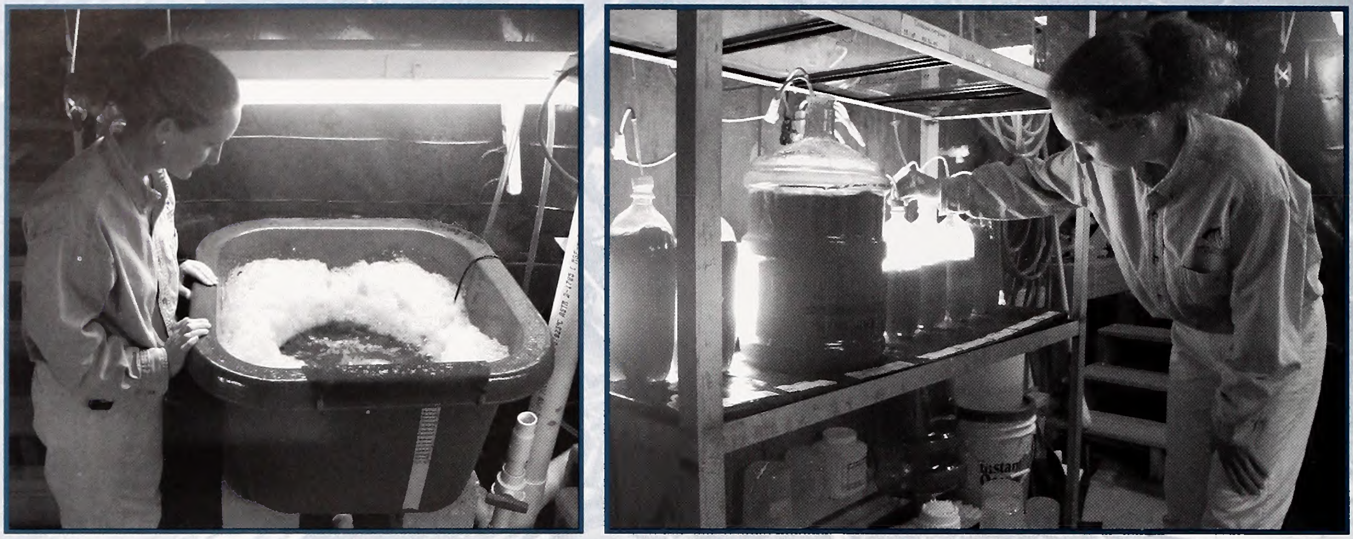


LEFT: Joanne Harcke, conservation and research coordinator at the Roanoke Island aquairum, checks out a basin of zooplankton called rotifers that are food for blue crab larvae. RIGHT: Harcke's algae buffet forms another part of the diet for developing crab larvae.

"One problem," Harcke says, "is how do you tell hatchery-reared from wild crabs." They look the same, she explains, and tagging would be difficult because they go through frequent molts.

Marc Turano, who oversees the Blue Crab Research Program for Sea Grant, says that while the issue of stock enhancement is debated among researchers, fisheries managers and others, he is enthusiastic about the success Harcke has had with raising crabs in the lab.

"Through her work, we have learned a lot about the life cycle — and we have learned a lot about the food preferences — of blue crabs," he says.

People who enjoy visiting the Roanoke Island facility may be surprised to learn the aquarium is more than a nice place to visit.

"As members of the American Zoo and Aquarium Association, the North Carolina Aquariums are encouraged to conduct original research and collaborate with other researchers on both *in situ* and *ex situ* projects. We're committed to establishing field conservation programs in North Carolina," Harcke explains.

As to collaboration with others, this project gets a little help from crabbers as well.

Endurance and the Crab

Murray Bridges is one of the crabbers who supplies Harcke with sponge crabs.

On the dock at his company, Endurance Seafood, near Colington, Bridges points out a crab beginning to shed. An opening has formed between top and bottom shells at the back end. Slowly, the peeler slides out of its former self — delicate legs last.

Now it is vulnerable — a soft-shell crab — and a more valuable commodity with an edible shell. Before long, its shell would harden in the wild, but this one will stay soft as it is packed in ice and readied for shipment to the Fulton Fish Market in New York.

Soft-shell crabs bring good money. If they didn't, Bridges says, there wouldn't be many soft-shell crabbers.

Tending peeler crabs is an around-the-clock job, indeed requiring endurance. In early spring, Bridges says, everybody's still smiling, but when business picks up, moods change with the workload. In a busy season, he can have 100 shedding boxes going.

Bridges is skeptical about reports of a decline in crab abundance. He has been crabbing for 30 years now and says, "I really, in this area here, haven't seen that much of a decline in crabs."

"There are those that holler about a decrease in crabs, and I say 'come out with me.' "

Bridges and other crabbers who supply Harcke with sponge crabs know how to handle them gingerly. "Careful handling of female crabs from the time the crabbers remove them from the pots until they enter the hatchery is critical for the success of the project," Harcke explains.

"They are carefully hand-selected to cut down on mortality," she says. If sponge crabs become stressed, they can tear the eggs off prematurely, Harcke attests.

Even though he hasn't seen a decrease in crab numbers, Bridges says, "I really support what she's doing. I think it's a great thing to start raising them."

It's not that Bridges doesn't see fluctuations in crab catches — he just sees them as natural. He says 2002 saw a "big change" in harvests, but he attributes this to the drought, which caused salinity to go up to 18 to 20 parts per thousand. Normal is 12 for his location, he explains.

Then there was the year of the hurricanes, when fresh water flooded the estuaries and, Bridges says, the crabs were pushed out by salinity changes.

As temperatures warm each spring, female peelers are targeted by crabbers.

Female blue crabs about to undergo a final molt seek out mature males, called jimmies, for mating and protection. A jimmy cradles the female, protecting her until she sheds.

Soft-shell crabbers capitalize on this process by using jimmies as bait. Bridges usually catches 10 to 15 per pot — sometimes many more with a good jimmy.

This is the only time in the female's life that she is capable of reproduction and the last time she will molt. She holds the sperm until conditions are right for forming the sponge, or egg mass.

ABOVE: A female crab sporting the "sponge" that consists of about one million eggs.

A female that survives to be a sponge crab could end up in Harcke's lab where, Harcke hopes, the chances of survival for released eggs will be much improved.

At the Crab Lab

At the aquarium on Roanoke Island, visitors mill about like ocean currents, peeking at alligators, gazing at ocean life, having close encounters with sea creatures at the "touch tank" and, via closed-circuit TV, spying on the osprey tending its raggedy nest outside.

Away from all the activity is a utilitarian little room aquarium-goers won't see. Along one wall, a row of recycled bottles gurgles with green and brown stuff, backlit by fluorescent bulbs.

In an aquarium sized for a kid's room or a high school science lab, Number One squats, wary, behind grass made of green curling ribbon.

Number One is a one-of-a-kind for the aquarium — the first from the batch of blue crabs raised last year.

In a larger aquarium, two full-grown females face each other. Last year, they provided eggs for the project.

Female crabs that have mated can retain some sperm for a second batch of eggs, Harcke says. She hopes these two may develop eggs again this year.

Scientists believe only about one of each million or so crab larvae will grow to adulthood in the wild. One has to wonder at the biological inefficiency of such a system. But Harcke explains the role of these crab larvae, called zoea, in the ecosystem.

"Everything has a niche," Harcke says. Unable to swim, zoea float passively with ocean currents to areas of higher salinity. Drawn toward sunlight, they become plankton — sacrificial pawns in a game of survival, providing food for fishes and other sea animals.

Then a dramatic change occurs. When zoea molt into megalopae, they can swim — though not yet beautifully — and propel themselves away from the light to which they were at first drawn. They also move toward areas of lesser salinity, traveling back to the estuaries.

Harcke explains that the endurance of the megalopae is heightened by osmoregulation, which allows them to tolerate higher degrees of salinity until they get into more favorable conditions in the estuaries, where they will at last become something that looks like minute, pinhead-size crabs.

Each dramatic metamorphosis brings new needs and food preferences. It's a challenge for the scientist attempting to provide sustenance for the blue crab from larvae to adulthood.

Working on the Food Chain

Here's food for thought for anyone, say, eating crab cakes in a seafood restaurant while staring out at a sound like the Roanoke: We know how we like to eat crabs — in creamy bisques, as dips, as stuffing for mushrooms or flounder. Some of us like them whole, right after they shed, as soft-shell crabs. And then there are crab cakes.

But what do we know about what they prefer to eat? Crabbers know how to bait a crab pot, but what about how to feed crabs that are newly hatched, planktonic members of the food chain themselves?

Harcke has learned a few things about the subject, and it wasn't easy.

"I'm doing more work raising food than growing crabs," Harcke jokes.

Her goal is to increase the eggs' one-in-a-million odds for survival. Keeping the zoea out of predators' reach is the first step, but they also have to be fed. Figuring out what they eat in the wild was educated guesswork.

The feeding experiments were meticulous — 250 zoea were individually lifted by pipette to one-liter beakers of artificial seawater, where they were given a variety of foods. At the end of five days, they were gently sieved out, examined under a microscope, counted, and determined to be dead or alive.

Harcke started with food that was easier to come by. In beaker after beaker, zoea were fed commercially available algae paste in various forms. They responded with what might be articulated as "give me something else or give me death."

Survival was zero until live algae were introduced. They are the bottles of green *Tetraselmas sp.*, and brown *Chaetocerous sp.* and *Isochrysis sp.* bubbling away in the lab, constantly aerated and grown using established culture techniques.

Combinations of live feed and algae paste were compared so that feeding procedures could be established. "It's like setting up a buffet," Harcke says.

Just as humans need a variety of foods for balanced nutrition, so do blue crab larvae.

In addition to the algae buffet, Harcke is growing zooplankton called rotifers. To the naked eye, they look like tiny dots. In a small container of seawater, they look like carbonation bubbles — except that the rotifers are very small and don't zip straight up. Under a microscope, they are round and randomly mobile.

So far, survival from the best buffet combination was greater than 20 percent. Less than impressed? Think of the one-in-a-million odds the newly hatched crab larvae get in nature.

This coming year, Harcke will add copepods — tiny crustaceans to make food for other crustaceans — in hopes of boosting survival even more for the lab crabs and, possibly, for those in the wild. ◘

HABITAT PROTECTION PLANS: HOMELAND SECURITY FOR FISHERIES

By Pam Smith

ABOVE: A dynamic and complex coast presents a challenge to those charged with protecting important fish habitats. This image is after Hurricane Floyd. Photo courtesy of SeaWiFS/NASA

High above Earth, a passing satellite blinks in recognition of North Carolina's unique geography: A line of barrier islands protects the mainland from the ocean's energy, channeling its flow through narrow inlets. Behind the barriers, irregular shorelines define a system of shallow sounds, bays and tidal creeks that are intricately tied to the ocean's will. Mighty rivers appear as threads connecting mountains to piedmont to coastal plain.

Ultimately freshwater rivers empty into coastal and marine waters, creating nursery grounds for the state's important commercial and recreational fisheries, as well as species that migrate along the coast.

But fish do not live by water alone. The water column swirls about a variety of underwater habitats that provide food and shelter necessary for spawning, breeding or growth for finfish and shellfish alike. The watery landscape includes ocean hard bottom, sand and mud bottoms, submerged aquatic vegetation (SAV), shell bottom, and freshwater and saltwater wetlands.

Healthy habitats provide the basic foundation for healthy fisheries. It's that simple. However, rapid coastal development, degraded water quality, dredging, and the use of certain fishing gear, such as trawls, are cited as contributing to both habitat loss and fishery declines.

Though the passing satellite offers only a snapshot of the dynamic and complex coast, it provides enough detail to suggest that developing Coastal Habitat Protection Plans (CHPPs) could be a daunting task.

Nevertheless, the N.C. Department of Environment and Natural Resources (DENR) is overseeing efforts to devise strategies to protect and restore fish habitats for the long-term enhancement of coastal fisheries.

When the North Carolina General Assembly passed the 1997 Fisheries Reform Act, legislators focused on ensuring healthy stocks, the recovery of depleted stocks, and the wise use of fisheries resources through fishery management plans as well as habitat protection plans.

For starters, DENR and the Marine Fisheries Commission have been working with the N.C. Division of Marine Fisheries (DMF) to devise management plans for each significant commercial and recreational species. The process involves input from commercial fishing groups, seafood dealers, recreational anglers, scientists and interested citizens.

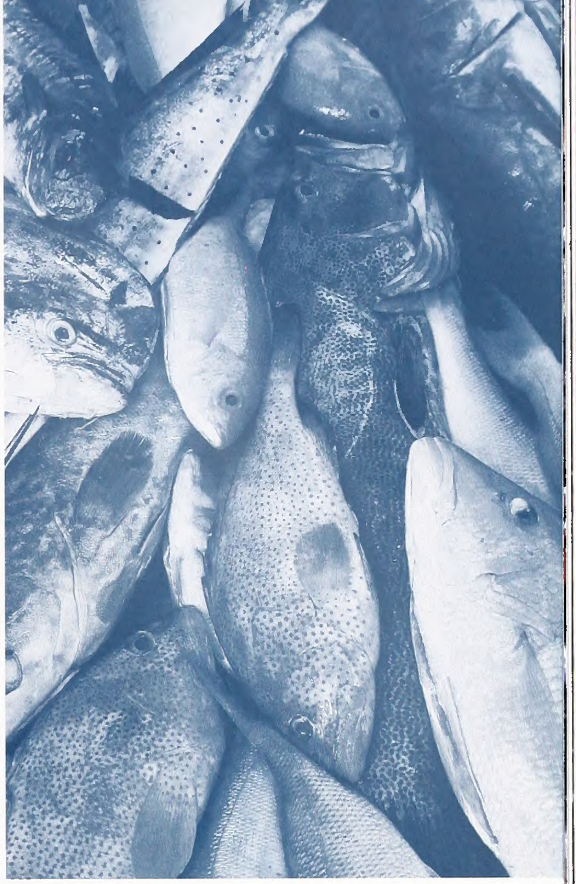
Attention now is focused on the process of developing habitat plans that will enlist similar public involvement, beginning with a series of public meetings this summer at coastal and inland locations.

MOVING AHEAD

It's a job so big, that the law requires three commissions to do the heavy lifting — the Marine Fisheries Commission (MFC), the Environmental Management Commission (EMC) and the Coastal Resources Commission (CRC).

An Intercommission Review Committee

LEFT: N.C. Coastal Federation volunteers learn the importance of healthy shell bottom habitats to the oyster fishery. Photo by Pam Smith



RIGHT: Commercial fish species require a variety of habitats through their life cycles. Photo by Scott D. Taylor

(IRC), with two members from each commission, is working with scientists from related state agencies as well as university researchers to describe and classify biological systems within each habitat, determine the habitats' value to coastal fisheries, and document threats.

The public will be asked to consider science-based remedies that the committee recommends.

Getting it all right will be critical to protecting coastal resources for the future. Committee members know that future regulatory actions by each commission must be consistent with the plans, once approved by the three commissions and adopted by the General Assembly.

After several false starts over a two-year period, the commissions regrouped last fall, hit the restart button and re-energized the process.

"There is no more important task for all three commissions than to develop Coastal Habitat Protection Plans. This is a task so important that no one commission can do it alone," DENR Secretary William Ross told a joint meeting last fall at the N. C. Aquarium at Fort Fisher.

"Natural resources are not inexhaustible," Ross said. "Many communities in the state see signs that they may be crossing important thresholds in the carrying capacity of natural resources."

While growth may be a foregone conclusion at the coast, Ross sees CHPPs as proactive measures with far-reaching benefits. The key could be helping citizens and decision makers make the link between land uses and healthy fisheries.

"We must extend the conservation message from the mountains to the open waters," Ross concluded.

To do so, says B.J. Copeland, "We will need to make our case so compelling, that citizens and legislators want to get involved."

Copeland, former North Carolina Sea Grant director, represents the marine fisheries commission on the IRC. He adds, "We may not need new regulations, but we do need to figure what we have and how they can work to protect habitat."

"The only way to make any of this work is to involve the people of North Carolina," says Will Fowler, an IRC panel member from the environmental commission.

One sure way is to show how doing things differently will produce a positive economic outcome, adds Fowler, retired owner of Coast Realty and Construction on Emerald Isle.

GETTING THE WORD OUT

Mike Street agrees that getting the public involved is critical. Street, DMF coastal habitat specialist, is working with the IRC to shepherd the CHPPs development process. He and staff members are researching the science that underpins each draft chapter for IRC scrutiny.

But for all the supporting science, Street knows it will be public support that will count in the final analysis. Involving the public, he says, creates advocates.

Street and DENR are working on education and outreach efforts that include print and video materials, funded with a grant from the National Oceanic and Atmospheric Administration.

A colorful brochure presents the CHPPs mandate and describes each habitat, while a 12-page tabloid, targeted for insertion in 25,000 coastal newspapers, provides more detailed scientific information.

A professionally produced video, *Fish and CHPPs,* introduces viewers to fellow citizens with strong ties to the coast, including a commercial fisher, a recreational angler and an oyster farmer. Ross provides a running narration and invites viewers to get involved in the discussion.

Continued on 19

WHAT ARE THE SIX COASTAL FISHERIES HABITATS –

and What Threatens Their Health?

1. WATER COLUMN

The water columns of rivers, sounds and sea are essential to all aquatic life. Water quality influences the health and abundance of finfish and shellfish, as well as life up and down the food chain.

Threats to the water column include pollution from stormwater runoff, sedimentation, turbidity, excess nutrients, bacteria, toxins, trash, invasive species and alteration of the natural flow of water.

2. WETLANDS

Wetlands include coastal saltwater marshes, freshwater and brackish swamps and bogs. Wetlands provide nursery and feeding areas for many finfish, as well as shrimp and crabs. Many anadromous fish spawn in or near wetlands. Wetlands also filter pollutants from stormwater runoff — protecting coastal waters.

Threats to wetlands include dredging, filling and draining for development, intensive agriculture and timber production, stormwater runoff, boat wakes and bulkheads.

3. SUBMERGED AQUATIC VEGETATION (SAV)

Sea grasses and other underwater plants grow in the shallow, coastal sounds and estuaries. They provide critical sources of food and shelter for many species of fish and marine life. Bay scallops, red drum, hard clams, blue crab, gag grouper and spotted trout depend on SAV for some part of their life cycles.

Pollution poses a primary threat to SAV. Sunlight, essential for photosynthesis, cannot penetrate murky waters polluted by stormwater runoff. Boat groundings, anchors and wakes and some fishing gear also are threats.

4. OCEAN HARD BOTTOMS

Ocean hard bottoms, both nearshore and offshore, are exposed areas of rock or hardened sediments. These areas provide spawning grounds for reef fish and cover and food for snappers, groupers, sea bass, king mackerel and flounder.

Threats include some fishing gears, such as trawls, boat anchors, dredging and ocean dumping.

5. SAND AND MUD BOTTOMS

Most of North Carolina's ocean, sound and river bottoms are comprised of a mixture of mud and sand. These provide key habitat for burrowing species — clams, mole crabs, worms — that are delicacies for mullet, blue crabs, shrimp and croaker.

Threats to these areas include dredging, mining, and deposition of toxic sediments from sewage discharges and polluted stormwater runoff.

6. SHELL BOTTOMS

Oysters live in the shallow waters of tidal rivers, creeks and sounds. More than 3,000 oysters can grow in one square yard of healthy habitat. Shell bottoms provide the substrate for more than other oysters. A variety of fish, including black sea bass and red drum, enjoy the smorgasbord of marine life that shell beds offer.

Cited threats to shell bottoms include diseases, boat wakes, dredging, sedimentation, invasive species, polluted stormwater runoff and certain fishing gear, such as trawls.

SOURCE: N.C. Division of Marine Fisheries. Images courtesy of N.C. Department of Environment and Natural Resources

The products — and the CHPPs speakers who are open to invitations from community organizations and local governments — are meant to foster a sense of ownership, stewardship and responsibility for coastal habitat. The public meetings will bring together citizens, scientists, state agency staff members and decision makers to address tough issues.

DENR is looking at the Chesapeake Bay Foundation as a model for community involvement here. What began there as a grassroots movement two decades ago has evolved into a multigovernment, interstate partnership that includes Maryland, Virginia, Pennsylvania and the District of Columbia; the Chesapeake Bay Commission; and federal government representatives.

For Pete Peterson, the idea of presenting ecosystem-based management plans rather than bureaucratic-driven plans may be just the approach needed.

"It is a breath of fresh air," he says. Peterson, an IRC member from the environmental commission, is a professor of marine biology at the University of North Carolina at Chapel Hill's Institute for Marine Science.

The three commissions working on this single issue underscores its importance to the public and politicians alike, Peterson says.

ENERGIZED ADVOCATES

Could the CHPPs process become a catalyst to unify volunteers, nonprofits and state and local governments?

Time will tell. But about a dozen N.C. Coastal Federation volunteers learn a potential carry-over lesson about shell bottom habitat one overcast Saturday in early spring.

They arrive at J&B Aquaculture Farm overlooking Stump Sound equipped with work gloves, shovels, and plenty of determination to "recycle" a mountain of about 400 bushels of oyster shells.

Some shovel. Others make quarter-bushel mesh bags. Still more volunteers take turns securing the bags with plastic twists. By midday, the mountain is reduced to a mere pile, and the bagged shells are neatly piled nearby.

J&B partners Jim and Bonnie Swartzenberg help transfer the bags into setting tanks built for the project. Once oyster larvae are introduced into the setting tanks, which are filled with filtered sound water, it is a matter of waiting for spat to attach to the shells. From there, the bags go into racks and are lowered onto a J&B-leased sound site. They will remain there until the spat hardens in about three weeks.

Meanwhile, oyster shell bottom habitats are being prepared to receive the next generation of oysters. One site is a federation demonstration project at Hoop Pole Creek in Atlantic Beach. Martin Posey, a Sea Grant researcher at the University of North Carolina at Wilmington, is constructing another shell bottom habitat site. Posey is conducting several oyster studies, including shell bottom design and oyster spat settlement. He also is exploring the potential of oyster restoration in certain now-closed tidal creeks.

"All habitat is under pressure," Posey says. "But the degree varies from place to place."

In some areas, shell bottom habitat is being destroyed by silt loading. In other places, water quality poses a threat. In some areas, both are issues. Turbid water and silting also contribute to the decline of sea grasses, he adds.

"The projects are a combination of habitat restoration and water quality and habitat improvement work," explains Ted Wilgis, the federation's Cape Fear Coast Keeper.

Oysters "planted" for demonstration or research are not to be harvested for consumption. Some will be placed for their filtering capacity to clean up water. Others can produce larvae for the future, he explains.

More importantly, the volunteers who have the battle scars from handling sharp oyster shells are probably "hooked."

"They love the hands-on activity," says Tracy Skrabal, federation senior scientist. "In one season they will gain a sense of the whole oyster ecosystem. They can see that what they do makes a difference. The educational value is unbelievable. They've learned about shell bottom habitat. And, learning that runoff pollution is a major cause of habitat destruction, they'll become advocates for clean water."

Swartzenberg points across the sound to Topsail Island. "Runoff is a major issue in these sounds, which once were prolific nursery grounds. I used to see only trees and green when I looked across at the barrier island. Now, I see only rooftops," he says.

Neighbors on a nearby creek suffer the consequences of seasonally high nutrient levels. Too many nutrients mean too much algae and too little oxygen for living habitat to survive.

CHPPs, Swartzenberg says, are important to commercial fishing. He repeats a message he delivers in the CHPPs promotional video: "We have a shared responsibility to protect these waters," he says. "We can have economic growth and environmental sustainability."

So, who should get involved in the CHPPs discussion? Ask James Barry Gaskill, a member of the CHPPs outreach advisory committee who has been fishing and crabbing for a living most of his life.

He'll tell you, "Anyone who catches fish or eats fish has a stake in the future." ◘

COASTAL HABITAT PROTECTION PLANS PUBLIC MEETINGS

(All meetings begin at 7 p.m.)

- **JULY 23:**
  N.C. Museum of Natural Sciences, Raleigh
- **JULY 24:**
  Mooresville Citizens Center, Mooresville
- **JULY 29:**
  Brunswick Electric Membership Cooperative, Supply
- **JULY 30:**
  Northeast Branch New Hanover County Library, Wilmington
- **AUG. 13:**
  East Carteret High School, Beaufort
- **AUG. 19:**
  N.C. Aquarium on Roanoke Island, Manteo
- **AUG. 20:**
  Town Council Chambers, Edenton
- **SEPT. 9:**
  Estuarium, Washington
- **SEPT. 10:**
  Pamlico County High School, Bayboro

To learn more about getting involved in the CHPPs process, or to request copies of the brochure, send e-mail to chpps@ncmail.net, *or go to* www.ncfisheries.net. *Copies of the video are available for community organizations. Videos can be viewed at the N.C. Estuarium in Washington and all North Carolina Aquariums, and aboard many state ferries.*

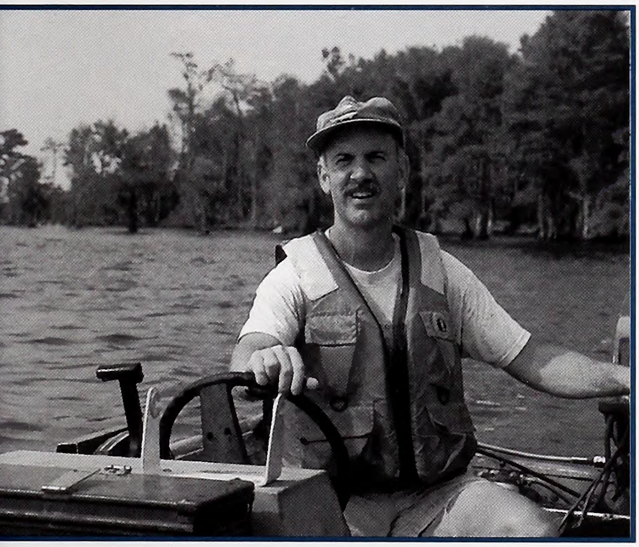
> *"THE POPULATION OF STRIPED BASS IS LARGER THAN WE HAVE EVER SEEN. WE ARE LOOKING TO SEE IF THE ECOSYSTEM IS OUT OF BALANCE."*
>
> — U.S.G.S. biologist Joe Hightower

Striped Bass Predation of River Herring Explored

By Ann Green • Photos by Michael Halminski

With an almost full moon glowing in the dark sky, North Carolina Sea Grant researchers are engaged in a tug of war deep in the Albemarle Sound.

Standing near the edge of a boat railing, four men pull in a line on a purse seine net — which closes up at the bottom like a drawstring on a woman's purse — in rhythmic motion.



Joe Hightower heads out along the Chowan River to collect striped bass.

Then the researchers examine a large catch of juvenile herring that have an iridescent glow in the dark.

"The density of juvenile river herring is higher than I expected based on recent data," says North Carolina State University zoologist Jeff Buckel. "We expected juvenile herring catches to be extremely low in the Albemarle Sound."

The purse seine net is just one type of gear used in a Sea Grant study that focuses on the mortality of two species of herring — alewife and blueback herring — in the Chowan River and Albemarle Sound prior to outward migration to the ocean.

Over the past year, researchers also have used beach seines, gill nets and bottom trawling to collect juvenile river herring and their predators. In recent years, both adult landings and juvenile recruitment of river herring have declined in North Carolina.

There has been much public concern about the negative impact of striped bass on economically important species, including river herring, Buckel says.

Striped bass populations along the Atlantic coast have grown dramatically in the last 15 years, says Buckel. In North Carolina, the number of striped bass that are more than four years old has increased eight-fold, according to a study by John Carmichael, a biologist with the N.C. Division of Marine Fisheries (DMF).

"The population of striped bass is larger than we have ever seen," says the Sea Grant project's co-investigator, Joe Hightower, a biologist with the U.S. Geological Survey. "We are looking to see if the ecosystem is out of balance."

Alternative Way of Collecting Fish

To determine the impact of striped bass predation on juvenile river herring, the researchers collect striped bass on the Chowan River by electroshocking — a process that uses a generator to send an electric current through the water, temporarily stunning the fish.

Electroshocking can be used in locations where large nets are not applicable, says Hightower. "The fish are attracted to the electric field and swim toward the boat. You can adjust the setting for different species," he adds.

After collecting the samples, scientists looked at the stomach contents of striped bass.

"Preliminary results show that the amount of river herring found in the stomachs of small striped bass is higher than what is found in larger striped bass," says Buckel. "However, small striped bass also feed on menhaden, silversides and bay anchovy. High densities of these alternative prey may provide juvenile river herring a refuge from predation."

Sea Grant researchers also looked at the growth and feeding rates of striped bass throughout the summer.

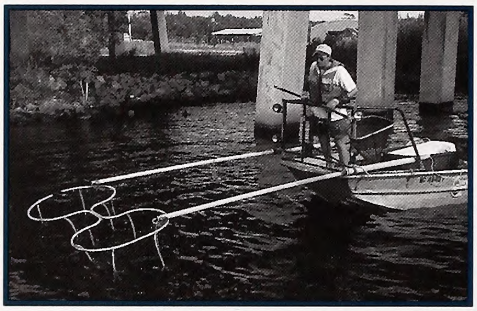
"Preliminary results from 2002 suggest that the growth and feeding rates of small striped bass were low in May and June, but increased in July," says Buckel. "This result was surprising and could mean that the impact of these small predators in early summer is minimal."

Researchers also found that large striped bass had a higher percentage of empty stomachs in August compared to other months. "This confirms earlier research that found large striped bass lose weight when the water temperatures are warm," says Buckel.

In North Carolina, striped bass as well as river herring are important for commercial fisheries.

After striped bass are caught, they go to packing houses and restaurants for consumer use. Some bluebacks and alewives go to fish-packing plants for transformation into herring with cream sauce or other delicacies, but most become fertilizer, fishmeal or bait.

Continued



TOP: Jeff Buckel records data for his striped bass study in the Chowan River and Albemarle Sound.
BOTTOM LEFT: At night, researchers obtain density estimates of river herring.
BOTTOM RIGHT: Electrofishing is used to collect fish under bridge pilings.

HERRING PRIMER

When North Carolina's dogwoods bloom, river herring aren't far behind. In March, alewives begin swimming up North Carolina's rivers to spawn. Bluebacks follow in three or four weeks. Both are anadromous fish that leave their salty ocean homes to seek spawning grounds in the shallow freshwater creeks where young are hatched. Spawning occurs from March into May in coastal rivers and estuaries.

When the first explorers and settlers arrived in North Carolina, they found rivers teeming with herring. In North Carolina, Algonquian Indians tended weirs or enclosures set for fish across the streams. Settlers raided those weirs or built their own, and "kippered" the fish with smoke and salt much like their European forebearers had done.

For generations, riverside communities celebrated the return of herring in local waters. Families scooped up herring with nets and baskets. Since river herring could keep for a year or more if properly cut and brined, it was often stored for fish suppers.

In the 1760s, commercial fisheries were established on several of the state's rivers. Pickled herring were shipped up the coast to Baltimore, New York and Boston, west to the Great Plains, and south to the West Indies.

Two Dutch brothers introduced the pound net in 1869, vastly improving the efficiency of the herring fishery. By the turn of the century, herring numbers were dropping markedly because of overfishing, pollution and the destruction of spawning grounds.

Still, North Carolina had a large herring fishery. Electricity and refrigeration were slow to spread to the remote eastern reaches of the state, and river herring remained one of the few meat sources poor families could afford. Until the mid-1900s, most households in eastern North Carolina had a barrel of "corned" herring stored in the kitchen.

From 1960 to 1976, many foreign fleets fishing ocean waters competed with the N.C. fishing community for river herring. With the establishment of the Exclusive Economic Zone in 1976, which banned foreign vessels within 200 miles of the United States, foreign competition for herring diminished.

HERRING QUOTA

Now, the state's dependence on herring is almost a memory. In 2000, the N.C. Marine Fisheries Commission approved the Albemarle Sound River Herring Management Plan that established a 300,000-pound quota. The quota is subdivided into 200,000 pounds for the Chowan River pound net fishery, 67,000 pounds for the Albemarle Sound management area gill net fisheries and 33,000 pounds for the other gears in the management area.

"River herring are still overexploited," says Sara Winslow, DMF fish biologist. "There has been little juvenile production in the last few years. In the last 10 years, the majority of the harvest for herring has been from the Chowan River pound net fishery."

In 2002, the commercial fishing industry in North Carolina landed 174,860 pounds in comparison to 306,761 pounds in 2001, according to DMF.

"Commercial fishermen didn't even meet the quota for the entire management area in 2002," says Winslow.

Each year, DMF samples the river herring harvest to assess the overall stock. Most of the herring harvested are 3 to 5 years old — usually first-time spawners — suggesting that the older ones have been fished out. Younger fish are still in the ocean, maturing before they spawn for the first time.

To restore river herring stocks and manage those stocks more effectively, the causes of low recruitment must be understood, Buckel says.

The Sea Grant study will allow for more informed decisions on the herring fishery, including predator-prey dynamics, by fishery management, he adds.

The study is just one part of the river herring's life cycle that needs to be examined.

"To fully understand recruitment of river herring, studies of all life stages — egg, larval and juvenile — are needed," says Buckel. "Additionally we know very little about the oceanic period of their life. Predation on juvenile herring in the ocean may be a significant source of mortality." ◘

Knowing Beans About the Beach

BY JULIE POWERS

> *"Always, then, in this flotsam and jetsam of the tide lines, we are reminded that a strange and different world lies offshore."*
> **From *The Edge of the Sea* by Rachel Carson**

Every so often, when the whims of wind and water coincide, tiny travelers bearing history, myth and mystery come ashore in North Carolina.

These little ocean-going envoys are called sea beans, and though many of them really are beans, they do not come from the sea itself. They are seeds from tropical vines, plants and trees that grow in faraway rain forests. They fall into the streams and rivers of the lower latitudes, and the water carries them to the oceans. There, sea beans can float with the currents for hundreds or thousands of miles, and for many months, sometimes years.

When the tides land them on our sands, they become the delight of discerning beachcombers who have learned to look for more than seashells.

"They could be from almost anywhere in the world," says sea bean collector Sherry White of Morehead City. "That's part of the fascination. Your imagination can just run wild."

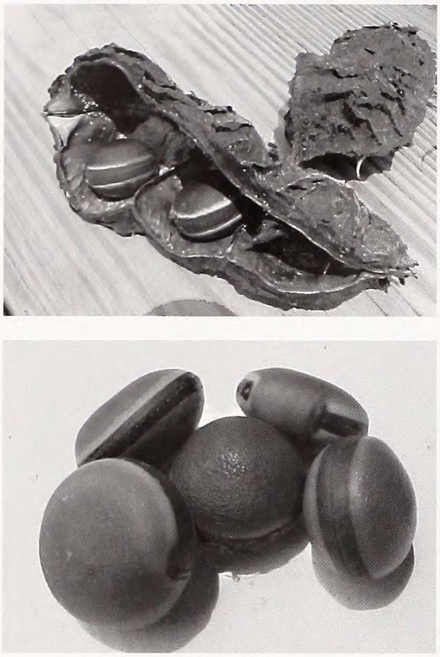
Sea beans, indeed, have been firing imaginations worldwide for centuries. Early Europeans thought these drift seeds floated up from underwater forests, and believed them endowed with curative — even magical — powers.

Certain sea beans have a curious countenance adding to their appeal. The hamburger bean, from vines along the Amazon, looks just like the entrée but for its dollhouse dimensions. In some countries, it's called a horse eye. One would expect the sea purse to snap open and spill out minute coins. Costa Rica's monkey ladder vine produces the valentine-shaped sea heart. Mary's bean, also called a crucifixion bean, bears the impression of a cross on one side and a womb-like image on the other.

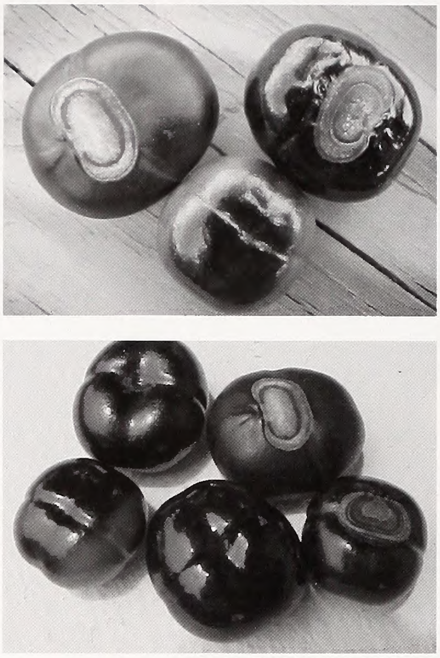
These and more can be found on North

Continued

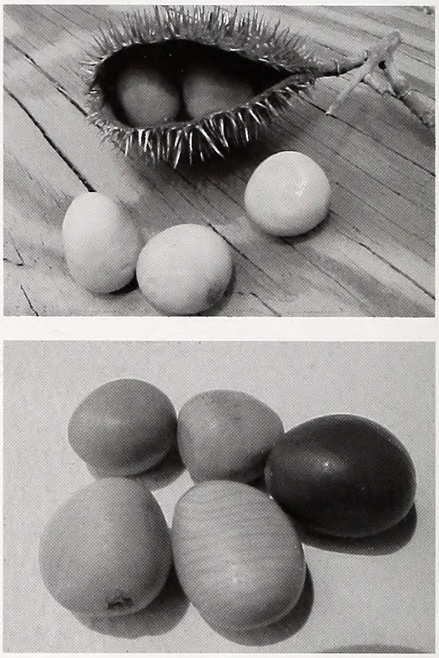
Photo by Edward L. Perry



TOP: Hamburger sea beans and pod
BOTTOM: Hamburger sea beans



TOP: Mary's sea beans
BOTTOM: Mary's sea beans



TOP: Nickernut pod and sea beans
BOTTOM: Nickernut sea beans

Photos by Edward L. Perry

Carolina shores. The book, *World Guide to Tropical Drift Seeds and Fruits,* says 22 varieties have been counted in the Carolinas.

But because most sea beans are brown and small and wash in with seaweed and other flotsam, they are easily overlooked. And many people, like White, publicity coordinator for the North Carolina Aquarium at Pine Knoll Shores, don't know what they've found when they encounter their first sea bean. A sea heart she discovered at Cape Lookout about 10 years ago piqued her curiosity. She was fascinated when she learned what it was.

"The mystery is what's intriguing," she says. "And how far they travel."

A WORLD VIEW

Sea beans come our way from the Caribbean, South America, Central America and the southernmost Florida Keys thanks largely to the Gulf Stream, the north-flowing river within the Atlantic off the East Coast. The beans turn up as far north as Cape Cod, though they become increasingly rare north of Cape Hatteras. Southeastern Florida beaches, on the other hand, are a collector's paradise, given the proximity to the sources.

Some sea beans are trans-Atlantic voyagers, reaching the United Kingdom, Norway, Greenland and Iceland. In the days before ocean currents were understood, sea beans gave rise to much lore and legend, as well as practical or medicinal uses.

The sea heart is said to have a hand in world history, inspiring Columbus to search for the lands to the west whence they came. The sea heart is still called the Columbus Bean in the Azores, some 800 miles off the coast of Portugal.

The Irish put sea beans under pillows to keep the mischievous "little people" away. On Scotland's Hebrides islands, sea pearls, also called nickernuts, were worn to ward off evil. Mary's bean held special meaning for the devout, and the expectant. Hebridean mothers in labor clutched a Mary's bean in hopes of an easy delivery and a healthy infant.

In old England, sea hearts were good luck charms for seafarers because they had weathered a long ocean journey. Babies teethed on the flint-hard coating of the seed, about the size of a silver dollar. Early Norwegians brewed a tea from the sea heart husk for women giving birth, and made medicine for cattle from the bean's insides. Some folks halved sea hearts, hinged the joint and made them into snuff boxes.

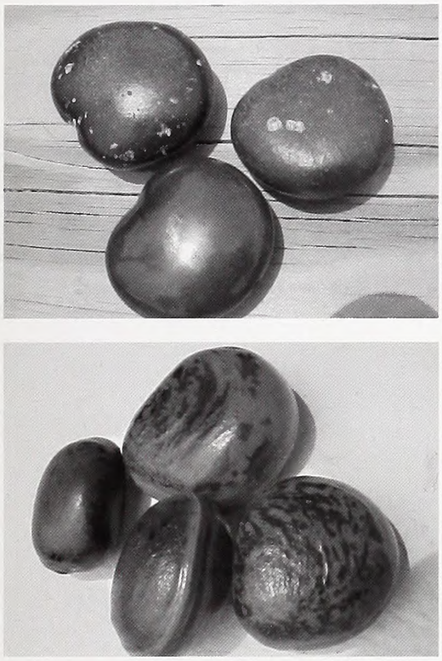
In modern times, some collectors polish sea beans for jewelry. Others puncture the outer coating and cultivate the seeds into indoor plants. Most, though, simply keep them as reminders of the ocean's wonder and the lands that beckon beyond the horizon.

ANY DAY CAN BE BEAN SEASON

Unlike seashells, sea beans are not an everyday find on North Carolina strands. A dedicated beachcomber might pocket only a few per year, making them all the more special, some say.

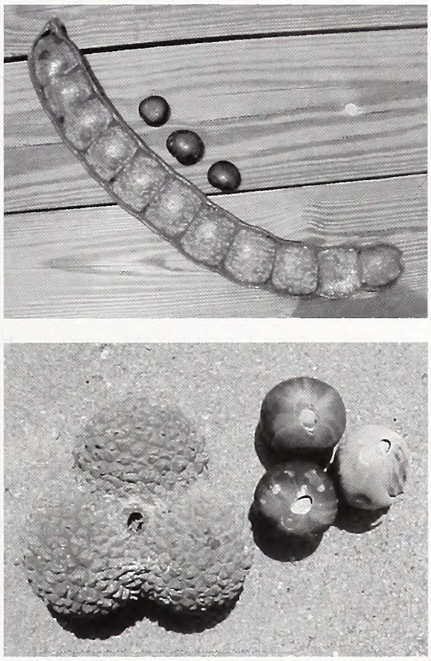
"I think that's the wonderful thing about sea beans," says Capt. Ron White of Morehead City, who conducts ecological sailing charters to Cape Lookout National Seashore. A marine biologist, he also has sailed Caribbean and Florida waters, and gathered dozens of sea beans since his father gave him a lucky bean — a sea heart — from Cuba as a child.

When a strong southwest wind sends ashore the sargassum often floating in the Gulf Stream, White says, he looks for sea beans. The variety he finds most often is the sea coconut — a dark, round, lightweight palm seed, also called a golf



Photos by Edward L. Perry

TOP: Sea heart sea beans
BOTTOM: Sea Purse sea beans



TOP: Sea bean pod and seeds.
BOTTOM: Golf Ball sea beans.

FOR MORE INFORMATION:

- *www.seabean.com* has sea bean background and details on the Eighth Annual International Sea Bean Symposium and Beachcombers' Festival, Oct. 10-11, Cocoa Beach, Fla.
- *The Drifting Seed* newsletter, P.O. Box 510366, Melbourne, FL 32951; also available on *www.seabean.com*
- *The Little Book of Sea-Beans and Other Beach Treasures*, Cathie Katz and Paul Mikkelsen, a pocket guide available through the sea bean Web site.
- *World Guide to Tropical Drift Seeds and Fruits*, Charles R. Gunn and John V. Dennis, revised edition, 1999, Krieger Publishing Co., P.O. Box 9542, Melbourne, FL, 32902-9542; phone: 321/724-9542; *www.krieger-publishing.com*.
- *Sea Beans from the Tropics*, Edward L. Perry and John V. Dennis, 2003, Krieger Publishing Co., P.O. Box 9542, Melbourne, FL, 32902-9542; phone: 321/724-9542; *www.krieger-publishing.com*.

ball, that grows in threesomes in a knobby capsule. Sea coconuts, sometimes still in their peculiar-looking pods, and other sea beans float a little higher than the seaweed.

"A strong southwest wind in the summer can bring in a treasure trove," he says. "If you look above the weed line, you'll find them."

While sea beans often ride in on a strong wind or a storm tide, offshore conditions can bring them on a calm day as well. Some Floridians consider fall sea bean season — some plants shed their seeds then, and hurricanes stir up the waters. Because they can drift for months, however, sea beans can appear year-round.

LOOKOUT FOR SEA BEANS

North Carolina's northernmost and southernmost beaches both sometimes have sea beans, according to the state aquariums at Roanoke Island and Fort Fisher. By most accounts, though, the currents are kindest to collectors around Cape Lookout. The Gulf Stream comes closest to our coast there, and its dynamics make surrounding beaches the destination for tropical tidbits.

"The stream is really a strongly meandering set of flows, with some meanders forming eddies that spin away from the main axis of flow," says Larry Cahoon, a North Carolina Sea Grant researcher specializing in biological oceanography at the University of North Carolina at Wilmington.

"The force of the stream also creates counterclockwise-moving flows in the coastal bays, such as Onslow Bay, the shelf waters between Capes Lookout and Fear," Cahoon says. "The Gulf Stream meanders that get entrained in the counterclockwise flows in shelf waters carry tropical water and flotsam inshore at Cape Lookout, which is why we see lots of tropical stuff in that area."

Near Hatteras, the Gulf Stream veers away from the coast, and conflicting currents tend to push floating objects out to sea. But many variables of wind and current can bring sea beans and other surprises from far-flung shores onto the beach almost anywhere.

Even at Cape Lookout, sea beans are something special. "You may find them once during the season when winds are right or storms are right or you just happen to be in the right place," says Cape Lookout National Seashore park ranger Karen Duggan. "They're wonderful little reminders of things to the South. We just don't get them often."

A MESSAGE IN A BEAN

Why sea beans travel so far from the tropics, when they cannot survive cold climates, is nature's secret. Perhaps the plants are expanding their range by indiscriminately sending seeds to sea, equipped for a long and wet passage. Some float because of a light-weight, fibrous coating; others have an air pocket inside a casing so hard that early Scandinavians thought sea beans were stones.

Whatever their reasons for their long journeys, sea beans continue to intrigue their finders, just as they have for centuries.

"Sea beans are among those things that regularly — not ten times a week but at least a few times a year — somebody will bring in and say, 'What is this?' " says Bob Patton, education curator at the North Carolina Aquarium at Pine Knoll Shores. He himself has found a few known sea beans, and a large, mysterious seedpod he has not yet identified.

A sea bean on the beach, he says, holds the same sort of mystique as a message in a bottle.

"You wonder how long has it been out there," he says, "and where did it come from?" ◘

Photo courtesy of The Lost Colony, Inc.

America's First Mystery: The Lost Colony

By Pam Smith

More than 400 years ago, the real-life drama of *The Lost Colony* played out on North Carolina's Roanoke Island. A brave band of English settlers — determined to establish the first permanent English settlement in the New World — embarked on an uncertain venture in 1587. Then they vanished without a trace.

The play by Pulitzer Prize-winning playwright Paul Green dramatizes the historic record of the exploratory voyages commissioned by Sir Walter Raleigh between 1584 and 1587.

"It's America's first great mystery," says Rhett B. White, executive manager of *The Lost Colony,* the first and longest-running outdoor symphonic drama in the country.

The play, produced by the Roanoke Island Historical Association (RIHA), debuted on July 4, 1937. In its 66 seasons, more than three million people have watched the story unfold under the stars at Waterside Theatre on the historic site where the settlers were seen last.

The 2003 season runs through Aug. 22 and is under the artistic direction of Terrence Mann for the third consecutive year. Mann — an award-winning Broadway actor/director and film star — cut his acting teeth as a member of *The Lost Colony* cast in the 1970s.

Continued

LEFT: The Lost Colony settlers seek the protection of Manteo. The cast traditionally includes local and professional actors. Even Andy Griffith launched his career in the 1952 production.

THE LOST COLONY 2003 SCHEDULE

WHEN: Through Aug. 22, 8:30 p.m. nightly, except Sundays and July 4

PRODUCERS: The Roanoke Island Historical Association

COST: $20 for producers circle; $16 for adults; $15 for senior adults; and $8 for children under 12. Children's tickets are half-price on Fridays and Saturdays.

WHERE: Waterside Theatre, Fort Raleigh National Historic Site, U.S. 64/264, Manteo

CONTACT: 866/468-7630

READ ABOUT IT: *The Lost Colony: A Symphonic Drama of American History* by Paul Green, edited by Paul G. Avery, University of North Carolina Press, 2001. Paperback, $12.95; *Roanoke Revisited. The Story of the Lost Colony*, edited by lebame houston and Barbara Hird. Penny Book, 1997. Paperback, $6, available at *www.thelostcolony.org.*

LEARN ABOUT IT: Go to *www.thelostcolony.org* and click on the Discovery Center icon for educational activities developed with a grant from the Z. Smith Reynolds Foundation.

TOP: Tony Award-winner William Ivey Long designed elaborate costumes for the long-running drama.

Photo courtesy of The Lost Colony, Inc.

MIDDLE: John Borden, left, crosses swords with Chief Pilot Simon Fernandez before boarding the fateful voyage in 1587.

Photo courtesy of The Lost Colony, Inc.

BOTTOM: Rhett White, executive manager of The Lost Colony, Inc., says the historic mystery attracts repeat audiences. He first saw it as a 4-H camper in 1954 — and countless times since.

Photo by Pam Smith

Through the years, productions have become more sophisticated; costuming, more elaborate; and lighting, more high-tech. New theatre seating and voice amplification enhance the audience experience. But no one has "tinkered" with the plot.

"Nothing could improve on the elements that continue to evoke strong feelings from the audience. It's a compelling story," White says.

HISTORY SETS THE STAGE

History sets the stage for the story that is told in drama and comedy, song, dance and special effects. The action shifts between the lavish court of Queen Elizabeth I and the stark landscape of Fort Raleigh, with a narrator telling of events both on and off stage.

The 119 men, women and children who set sail from Plymouth, England, on May 8, 1587, could not have imagined the trials they would face, says lebame houston, RIHA historian. An Elizabethan scholar and author who prefers her name in lower case, houston relentlessly searches London records to learn about the era of heroic exploration — and tragedy.

Water, wind and weather were among the natural forces the colonists would confront from the start, she says. The treacherous ocean currents and shifting inlets along the Outer Banks confounded even experienced ships' pilots. Fierce storms might deliver a ship to the "Graveyard of the Atlantic" or run it aground in shallow sounds.

The misdeeds of countrymen proved to be another dangerous force at work against successful colonization says houston.

A colonization attempt under Gov. Ralph Lane in 1585 — meant to pave the way for a permanent settlement on Roanoke Island — went sour. Conflicts with Roanoke King Wingina smoldered. Plots and counterplots climaxed when Lane's men attacked the tribal village and beheaded Wingina.

This fatal blunder sounded a death knell on the future of English colonization there, houston says. Members of Wingina's tribe — led by his kinsman, Wanchese — would become deadly threats. And, inept at setting fish nets and ill-prepared to grow crops suitable to the mid-Atlantic climate, the settlers no longer could rely on the Indians for their food supply.

In spite of failed missions, Sir Walter Raleigh kept the venture alive, and mounted the ill-fated 1587 voyage under Gov. John White.

Ironically, Raleigh, a champion of England's colonial expansion, never set foot on North American shores.

ART REFLECTS LIFE

In 1587, against all odds, the settlers unwittingly boarded a ship — this time destined for Chesapeake Bay to establish a new settlement in the queen's name.

Among them were Gov. White; his pregnant daughter, Eleanor Dare; her husband, Ananias Dare; John Borden; Tom Harris; and chief pilot Simon Fernandez.

When they reached the Outer Banks three months later, stormy seas swamped the provisions and nearly wrecked their ship.

"White and Fernandez had been at odds nearly from the start of the voyage, but it was the last straw when White accused Fernandez of incompetence," houston says.

White and the settlers were forced to disembark at Roanoke Island — without a full store of provisions and at the mercy of hostile Indians.

The weary voyagers aquiesed, heartened by the promise of protection from their friend, the Indian Manteo. They hailed the birth of Virginia Dare on Aug. 18 as a renewed commitment to English colonization in the New World.

At the settlers' urging, Gov. White set sail for England to solicit needed provisions for the colony. But history dealt another blow. No ship could be spared. Elizabeth summoned all resources to defend England against the Spanish Armada.

It's here that the historical record is sketchy and playwright Green invokes creative license to play out the colonists' tragedy.

Hunger, hardship, illness and death beset the struggling settlers. With the death of Ananias Dare, Borden assumes leadership and faces the reality that no help is coming from England probably because of a prolonged war with Spain.

Winter approaches, the food supply is dwindling, and their protector, Manteo, has died. Now, a Spanish war ship has anchored in the inlet.

Borden must lay out the hard choices to the colony: Would surrender to the Spanish mean survival or death? Should they stay and defend the fort? Or, should they follow Manteo's people farther south to the tribal home in Croatoan (an island extending north of modern Cape Hatteras), where wild game might be more plentiful?

They choose Croatoan. And one last time, Borden must rally the courage of the rag-tag group as they prepare to leave the fort.

Gesturing toward the flag, he says, "Here in this new world we have planted the emblem of our race — of people who are free. … And down the centuries that wait ahead, there'll be some whisper of our name — some mention and devotion to the dream that brought us here."

With that, they disappear into history, which has recorded their names and their story, but not their fate.

When Gov. White returns to Roanoke Island in 1590 he finds only an abandoned fort and the words "CROATOAN" and "CRO" carved on a tree and a post.

Historians and archeologists persevere in the hunt for clues that will solve the mystery. "We haven't given up on the search," houston insists.

A LOCAL TRADITION

When the production opened in 1937, some assumed it would run for a single season to commemorate the 350th anniversary of the birth of Virginia Dare. But from the start, members of the local historical organization were determined to have Roanoke Island recognized as America's birthplace — an ambition matched by playwright Green's long-time dream to tell the colonists' story.

Rhett White attributes its longevity to the community's continuous involvement with every aspect of what is now a local tradition.

"*The Lost Colony* was a child of its era," writes Laurence G. Avery in the introduction to the newest edition of *The Lost Colony* (UNC Press, 2001). "At no other time could it have been gotten together in just the way it was in 1937. With its grassroots origin, community spirit and celebratory aim, the production was precisely the sort of effort to attract national attention during the New Deal phase of the Great Depression."

At the time, the Civilian Conservation Corps (CCC) was building dunes on the Outer Banks' barrier islands. A CCC crew was recruited to work on the outdoor theatre; equipment came from the Rockefeller Foundation and the University of North Carolina at Chapel Hill. Leading actors were professionals from the Federal Theatre Project.

A rave review from a *New York Times* drama critic attracted the desired national attention. It also helped when President Franklin D. Roosevelt attended a performance on Aug. 18, the birthday of Virginia Dare. And, Avery notes, "The play became a cause for Eleanor Roosevelt in her efforts to enrich the lives of depression-era Americans through the arts."

It's estimated that 50,000 people saw the production during that first season — remarkable considering there were no four-lane highways or modern causeways to the island. One route involved traversing several miles of swamp on "the floating road," which Avery describes as " a sixteen-foot-wide strip of asphalt suspended on steel cables hitched to pilings."

After all these years, the play continues to inspire audiences with Green's core message: equality is fundamental to a democratic way of life.

In the play, Tom's character illustrates Avery's point that frontier life broke down European class boundaries. Tom rises from a place of ridicule in English society to a leadership role in the colony.

He says, "But I who was lately nothing am become somebody. … Roanoke, thou hast made a man of me." ◘

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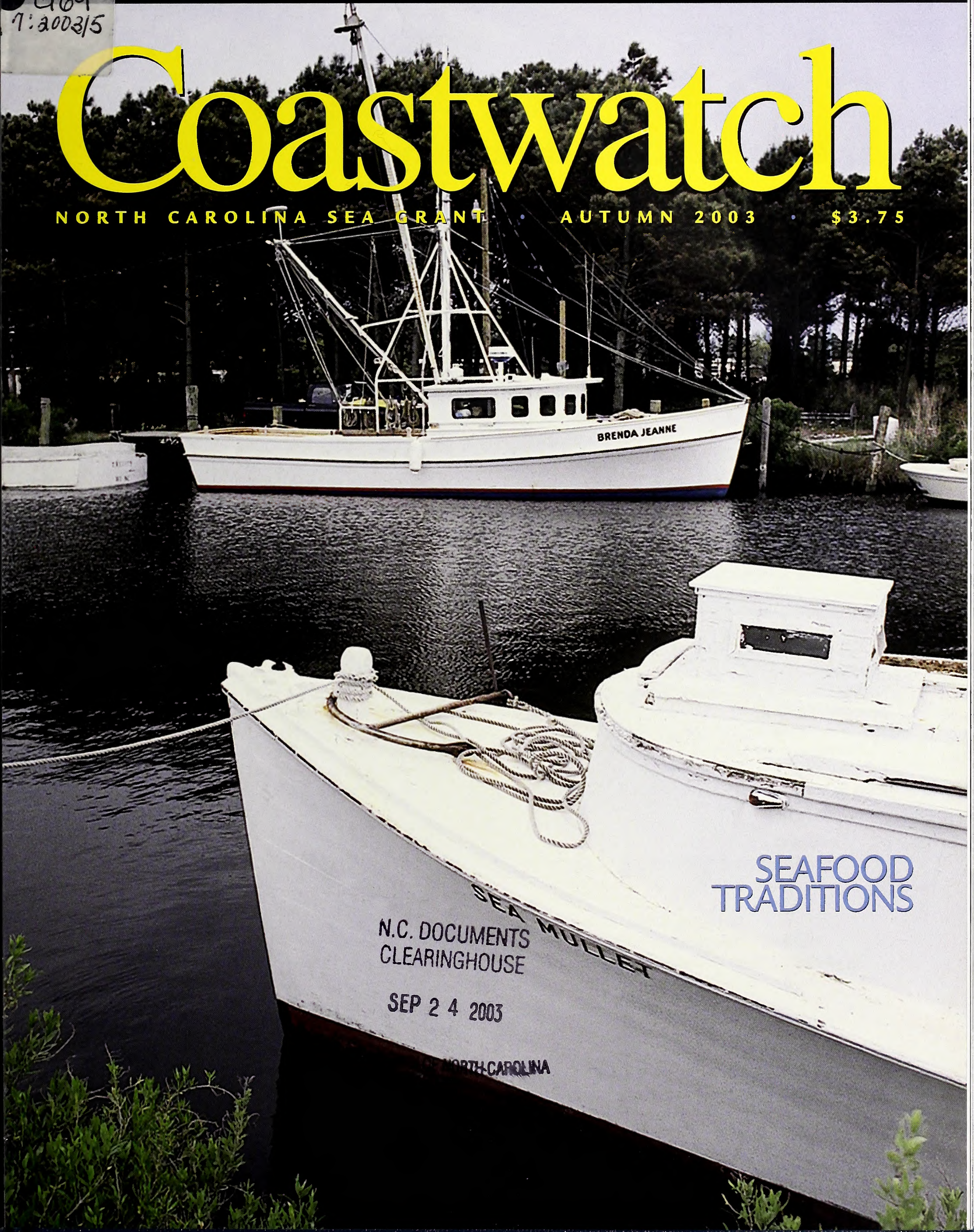

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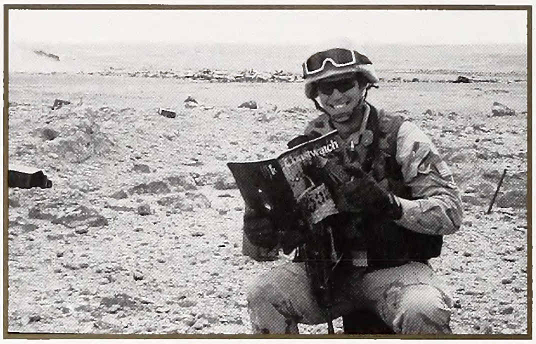


Photo courtesy Sgt. Adam Dillon

Army Sgt. Adam Dillon takes a break from war duties to keep in touch with news from coastal North Carolina, thanks to his grandfather and Coastwatch *magazine.*

From time to time, I receive notes from readers. Not long ago, an e-mail message revealed just how far *Coastwatch* may travel. There was Army Sgt. Adam Dillon, reading an issue in western Iraq. A Special Operations comrade snapped the image during a lull in duties.

A picture may be worth a thousand words, but the reporter in me needed a few more details as to how and why *Coastwatch* made the trip to Iraq. So, here is the rest of the story:

No matter where his military duties take him, coastal North Carolina always will be home for Adam, who was born and raised in Wilmington. "I grew up around Greenfield Lake. That is where I learned to fish and had my first experience with pollution of our wetlands," he writes.

"My family made sure I learned how to be a proper beach fisherman down at Carolina and Wrightsville beaches. My father, who lived in Brunswick County, would often take me with him and friends out to Rice's Creek and the Intracoastal Waterway to catch shrimp in nets and flounder gig in the bay of Southport."

His grandfather, Obbie M. Blanton, who retired from the Wilmington Police and later worked for campus police at the University of North Carolina at Wilmington, always emphasized the coastal environment — even sending young Adam to "sea camp" sessions at UNC-W and encouraging him to take oceanography in high school.

"I would carry him out crabbing and take him fishing when he was a kid," recalls Obbie, who picked up *Coastwatch* one day at the UNC-W Center for Marine Science. He became a subscriber — and started saving his copies for Adam.

"My grandfather likes to keep the issues for me, and then discuss the articles after I have read them," Adam explains.

In 2000, when Adam had an extended assignment in Korea, his grandfather began adding the magazines to "care packages" along with other luxuries such as his grandmother's zucchini bread. The magazine had a place of honor on Adam's desk. "Not only did American soldiers read copies of *Coastwatch* in Korea, but I had several South Korean soldiers working for me. They loved to see the pictures of coastal N.C."

The Holiday 2002 issue of *Coastwatch* arrived while Adam was in Jordan, one of the few pieces of reading material he and his unit received in that deployment. He loaned it out, but kept track of it through several countries.

"They were asking each other for the copy of that 'North Carolina Ocean' magazine. It was almost as popular as *Maxim*," Adam writes.

Our magazine didn't just pass time for Adam. "*Coastwatch* helps keep me abreast of issues affecting coastal N.C. and colorful stories about tidewater Carolina history and living."

And now, Adam will continue a family tradition of sharing that love of coastal Carolina with a new generation. He arrived back at Fort Bragg in time to be with wife Jenny for the birth of their first child — a son named Connor — in late June.

"How can we expect to keep our coastal regions clean, intact and useful for years if we do not educate each other and most importantly our young Carolinians that will inherit this region from us?" Adam asks.

Thanks, Obbie and Adam. I couldn't have said it any better.

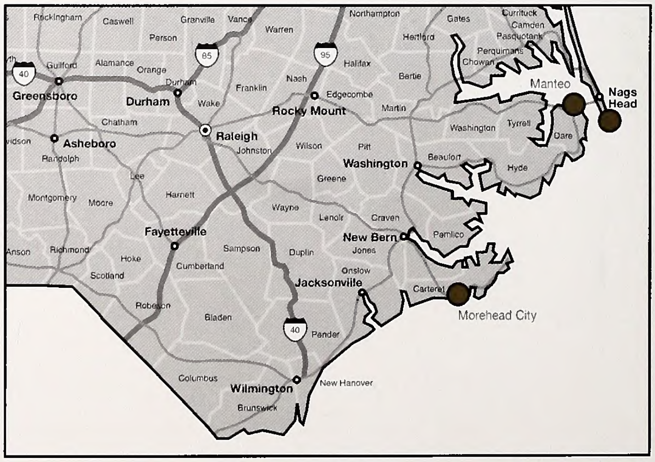
Katie Mosher, Managing Editor

IN THIS ISSUE

Contributing Writers:
Ann Green ▫ Lilly Loughner ▫ Katie Mosher
Sarah Friday Peters ▫ Pam Smith ▫ Joyce Taylor

Contributing Photographers:
Darren DeSoi ▫ Dirk Fletcher ▫ Michael Halminski
Bill Russ ▫ Pam Smith ▫ Scott D. Taylor

North Carolina's diverse coast offers countless interesting subjects. The large dots on the locator map indicate story settings in this issue — including Manteo, Hatteras Island and Carteret County.



Coastwatch

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Coastwatch

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The North Carolina Sea Grant College Program is a federal/state program that promotes the wise use of our coastal and marine resources through research, extension and education. It joined the National Sea Grant College Network in 1970 as an institutional program. Six years later, it was designated a Sea Grant College. Today, North Carolina Sea Grant supports several research projects, a 15-member extension program and a communications staff. Ron Hodson is director. The program is funded by the U.S. Department of Commerce's National Oceanic and Atmospheric Administration and the state through the University of North Carolina.

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Front cover photo of Harker's Island and table of contents photo of mullets by Scott D. Taylor.

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COASTAL *TIDINGS*

North Carolina Suits Up

Bill Russ

Darren DeSoi

Key West. Channel Islands. British Columbia. North Carolina maintains its rank amongst preferred exotic scuba diving locations in North America. Rodale's *Scuba Diving* magazine gave North Carolina high grades in its 10th Annual Top 100 Awards.

With added points for uniqueness, North Carolina took first place for Top Wreck Diving and Top Places to Dive With Big Animals. The state also ranked second for Top Underwater Photography, second for Top Advanced Diving, third for Repeat Performance, fourth for Top Visibility, and fifth for Top Fish Life.

And out of anywhere in North America that you could dream of diving, North Carolina came in second as the Top Dive Destination.

From our very own Morehead City, Olympus Dive Center tied for first as Dive Operator with Top Values and came in third as Top Dive Operator.

North Carolina's awards come as no surprise to Patricia Wuest, editor for *RSD*, who says the state is "extremely popular among wreck divers, since it takes an advanced diver with a lot of experience under their belt to dive in North Carolina."

"The historic wrecks can be very moving for some divers," says Wuest. And the big sand tiger sharks are almost a guaranteed sight among the wreckage.

View statistics for North Carolina's scuba awards at *http://scubadiving.com/feature/specials/200302top100/.* – L.L.

Four from N.C. Make Best Beach List

Dr. Beach, aka coastal scientist Stephen Leatherman, named four North Carolina beaches to his 2003 Best Beaches in America list.

Coquina Beach at Cape Hatteras, Hammocks Beach State Park, Holden Beach and Ocracoke Island beaches are among the 38 deemed best in the country.

The rating system is based on a scale of 50 criteria, ranging from sand softness to water quality. Leatherman's emphasis is on a balance of sustainable development with ecological preservation.

The list is compiled each year by Leatherman for *National Geographic*'s Smart Traveler feature.

– P.S.

In the Next Issue of *Coastwatch*

Venture to Bird Island, where Ann Green introduces Sea Grant researchers documenting the barrier island off Sunset Beach. Julie Powers takes you to Lukens, a Carteret County town that is no more. And Lilly Loughner suggests coastal books for holiday gifts.

'Estuary Live' Brings Coast to Classrooms

Scott D. Taylor

This month, students across the country will take field trips to estuaries along the Gulf, Atlantic and Pacific coasts — and never get sand in their shoes.

"Estuary Live," an interactive online production, introduces students to estuaries in North Carolina on Sept. 23 and 24.

The webcast becomes a coast-to-coast experience Sept. 25 and 26 when students "tour" estuarine reserve sites in an additional eight states.

Part of the 2003 National Estuaries Day celebration, "Estuary Live" is sponsored by NOAA's National Estuarine Research Reserve Program and the Environmental Protection Agency's National Estuary Program.

Since "Estuary Live" was developed three years ago by Susan Lovelace, education coordinator at the N.C. National Estuarine Research Reserve, the program has grown into an international event. It's estimated that more than one million viewers logged on last year to learn about the dynamic ecosystems.

At each stop on the itinerary, estuary guides highlight unique features and answer questions submitted electronically by viewers.

Organizers call the webcast "the next best thing to being there." The field trips are free, but registration is required to interact with the guides. For information and to register, go to *www.estuarylive.org*. — P.S.

Photos by Dirk Fletcher

View Titantic Exhibit

When the legendary ship *Titanic* sank in April 1912, more than 2,200 passengers were on board — from titans of commerce to immigrant dreamers.

Hundreds of artifacts recovered from the shipwreck will be on display at the North Carolina Museum of Natural Science through Jan. 4, 2004. In "Titanic: The Artifact Exhibit," visitors can see a suitcase, felt bowler hat, glassware and other artifacts.

The 7,500-square-foot exhibit takes visitors on a chronological journey through the life of the *Titanic* — from the building of the legend to life on board. Authentically recreated first- and third-class rooms have furnishings made by the original manufacturers.

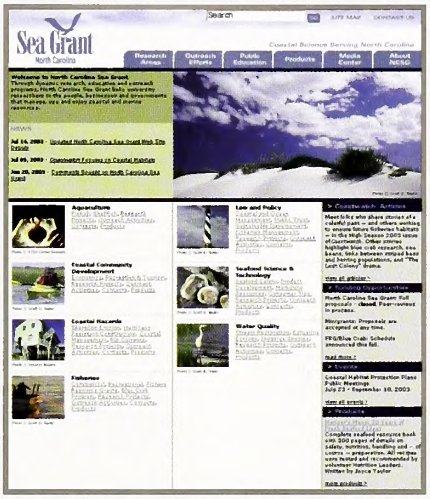
Visitors also can press their palms on an iceberg and feel what it must have been like to be in the water on the night that the ship sank.

Admission to the museum is free. Tickets to the special *Titanic* exhibit are $12.50 for adults; $7 for children 4 to 11 and seniors over 60; $10 for groups; $5 for school groups; and $6 for Friends of the Museum of all ages.

For more information, visit the Web: *www.naturalsciences.org* and click on *Titanic* exhibit.

— A. G.

North Carolina Sea Grant Updates Web Site



Finding North Carolina Sea Grant information online has gotten easier. Sea Grant has updated its Web site, which explains the program's mission and highlights research and outreach projects — from aquaculture to water quality.

The new site has a new address: *www.ncseagrant.org*.

Visitors to the site will find information on a wide range of Sea Grant topics, as well as links to products, Sea Grant experts and related links.

"We are pleased to have improved our online presence," says North Carolina Sea Grant Director Ronald G. Hodson. "We will continue to add content to the site, so we hope people will check back often. We hope they will let us know how the new site is working."

Anyone with questions regarding content on the site should contact Katie Mosher, communications director, at *katie_mosher@ncsu.edu*. Those with technical questions should contact Tammy Sumner, finance & information systems director, at *tammy_sumner@ncsu.edu*. — K.M.

Big Sweep Set for September

Volunteers from the coast to the mountains will roll up their sleeves on Saturday, Sept. 20, to take part in North Carolina Big Sweep, the annual statewide waterways cleanup.

Founded as Beach Sweep in 1987 by former North Carolina Sea Grant marine educator Lundie Spence, the event has grown from its original 1,000 volunteers along ocean beaches. To date, more than 178,600 volunteers have collected more than 3,132 tons of trash.

Last year, more than 15,100 North Carolina citizens collected 287 tons of trash in the one-day effort. And the Big Sweep team covered more than 1,200 miles of stream, river, sound and ocean shores.

North Carolina Big Sweep Inc. also sponsors the Adopt-A-Beach program and provides a variety of educational resources to encourage environmental stewardship.

To join the volunteer team on Sept. 20, or to find out more about North Carolina Big Sweep, go online to *www.ncbigsweep.org*, call 919/404-1698 or e-mail *ncbigsweep@mindspring.com*. — P.S.

Visit Mitchell Exhibit

When Gen. Billy Mitchell used a military airplane to destroy decommissioned battleships off the coast of North Carolina in 1923, he established a milestone in the use of air power.

A special exhibit, "Mitchell On Hatteras," is on display at the new Graveyard of the Atlantic Museum in Hatteras to honor the general's achievements.

Mitchell's theories on military air superiority, coupled with his demonstration of air power, contributed to establishing the United States Air Force.

As part of the 2003 Wright Brothers Centennial Celebration, the exhibit opening on Sept. 5 will include fireworks and a barbecue. Other activities to honor Mitchell are planned for Sept. 26.

For more information, call 252/995-6956. — A.G.

Workshops Take Aim at Pollution

A series of coastal community workshops, "Controlling Microbial Pollution in Your Community," takes aim at the cause of shellfish bed closures and swimming advisories.

The workshops, which will run from 9 a.m. to 4 p.m., will be held at four locations: Sept. 4, Museum of Coastal Carolina, Carolina Beach; Sept. 9, Duke University Marine Lab Auditorium, Beaufort; Sept. 11, Cape Fear Community College Satellite Campus, Hampstead; and Sept. 16, N.C. Aquarium on Roanoke Island.

The series is presented by the N.C. Coastal Nonpoint Source Program and the N.C. National Estuarine Research Reserve. North Carolina Sea Grant is a cosponsor.

Each workshop will address why microbial pollution is a threat to public health and local economies and introduce the latest science behind management strategies. Participants also will learn how to become involved in microbial pollution prevention.

Participation in the workshop is free, but registration one week prior to the workshop date is required.

To register, contact Whitney Kurz at *whitney_kurz@ncnerr.org*, or Lori Davis at *lori_davis@ncnerr.org*. Or call 252/728-2170. — P.S.

Michael Halminski

Get set. Go.

***TOP:* Carl Classen, leader of the local Network for Endangered Sea Turtles (NEST), gets ready to release a loggerhead turtle after its rehabilitation at the NEST Rehabilitation Facility at the North Carolina Aquarium on Roanoke Island. *BOTTOM:* Volunteers cheer as the 47-pound loggerhead, a threatened species, makes a 'dash' for the ocean at Coquina Beach on Hatteras Island. It is one of 18 stranded turtles treated by aquarium staff and NEST volunteers this year.** — P.S.

Seafood Festival Oct. 3-5

Save the first weekend of October to celebrate a taste of coastal tradition. The 17th Annual North Carolina Seafood Festival is set for Oct. 3-5 in Morehead City.

The community event kicks off with a Friday evening fish fry, and swings into high gear on Saturday and Sunday with a host of activities along the port city's waterfront — all designed to celebrate the contributions of the seafood industry to North Carolina.

North Carolina Sea Grant will be among the dozens of exhibitors in the Coastal Today educational tent. With the theme, "Life at the Edge of the Sea," visitors will get a sampling of the ecological, commercial and social importance of seafood. Highlights include a touch tank for kids of all ages, and the debut of North Carolina Sea Grant's *Mariner's Menu* — a seafood resource book by long-time Sea Grant seafood specialist Joyce Taylor.

The street festival activities include seafood sampling, in-water demonstrations, arts and crafts, street dances, music and entertainment on outdoor stages.

Sunday activities begin with a traditional blessing of the fleet ceremony to commemorate members of the fishing community who have died.

For more about the event, go online to *www.ncseafoodfestival.org*. — P.S.

Sea Grant Projects Honored

North Carolina Sea Grant won two 2003 Apex Awards for Excellence — both for products resulting from partnerships.

The "Rip Currents: Don't Panic" public education campaign included the placement of 600 rip current safety signs along our coast, and several media events to draw public attention to the danger of rip currents. The effort was built on earlier posters, brochures and videos that were widely distributed.

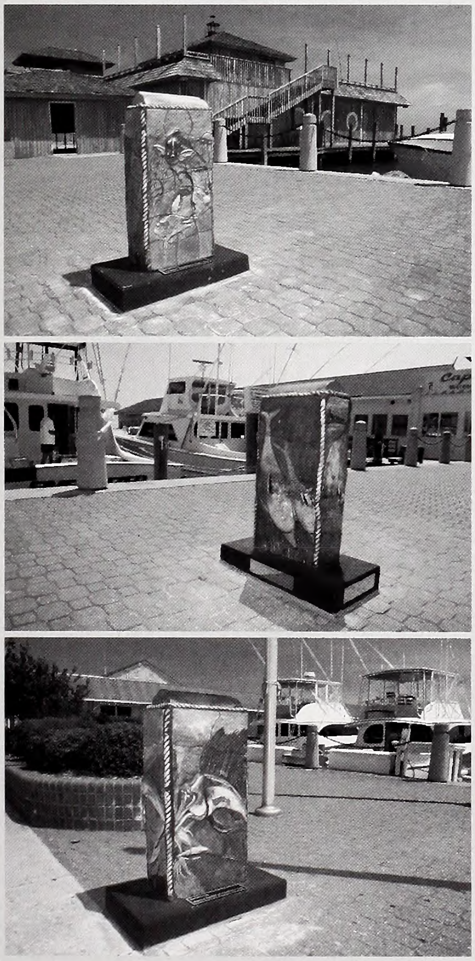
Partners included the National Weather Service and North Carolina beach communities. Spencer Rogers, Sea Grant coastal erosion specialist, and Lundie Spence, former Sea Grant marine education specialist, provided technical assistance and interacted with the media.

In addition, our "Shark Sense: Atlantic and Gulf Coasts" brochure took honors. It was funded by a Fisheries Extension Enhancement Program competitive grant from the National Sea Grant office.

Sea Grant communicator Ann Green pulled together a diverse committee to agree on text for the brochure. Local funding was provided by the N.C. Aquariums and Dare County Emergency Management.

The committee also included representatives from the NOAA Fisheries Highly Migratory Species Division; Florida and Rhode Island Sea Grant programs; the Sea Grant National Media Relations Office; the International Shark Attack File; Mote Marine Laboratory; the U.S. Lifesaving Association; and the National Parks Service.

For information about ordering rip current or shark materials, go online to *www.ncseagrant.org*, or call 919/515-9101. – K.M.


Photos by Scott D. Taylor

Fish Out of Water?

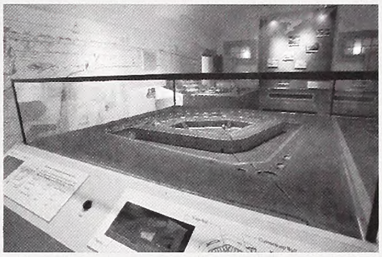
Who knew you could have the best of both worlds – land and sea?

The Downtown Morehead City Revitalization Association (DMCRA) did just that as they planned and installed maritime art along downtown waterfront streets. "FishWalk" includes an array of wonderfully colored and textured sculptures of fish native to the area.

People are "fascinated by the way the fish look and are depicted," and even more so by "the fact that they can touch them," says Bruce Naegelen, executive director of DMCRA.

The mahi mahi, bottlenose dolphin and sailfish sculptures already are on display. And plans for the completed FishWalk include 25 pieces. Local artists Keith Lambert and Willie Baucom of Beaufort had the "best concept for the project," says Naegelen.

But why a FishWalk? "Public art has the power to define a public space, enhance the visual appeal of a community, foster pride and identity, creatively solve problems, and encourage interaction and promote tourism," says Jeffery York of the N.C. Arts Council. – L.L.


Photos courtesy of Fort Macon State Park

Restored Fort Macon Opens

Visitors returning to Fort Macon at Atlantic Beach will discover that the historic citadel has been transformed into a shining "jewel of the state park system."

The four-year improvement project includes the addition of six new exhibits that chronicle the fort's 169-year history. The fort was completed in 1834 as part of a national coastal defense system.

At the beginning of the Civil War, Fort Macon was alternately in the hands of the Confederacy and Union forces. It was a federal prison from 1867 to 1869, garrisoned during the Spanish-American War, and closed in 1903. The state purchased the site from Congress in 1923. Later restored by the Civilian Conservation Corps, it would guard the coast one more time during World War II.

The new exhibits are uniquely displayed in six casemates, the fort's armored rooms. The project was funded by the state's Park and Recreation Trust Fund and an allocation from the N.C. General Assembly.

Fort Macon State Park is open year-round.

For information, go to: *www.ils.unc.edu/parkproject/visit/foma/home.html* or call 252/726-3775. – P.S.

SEAFOO
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SEAFOOD TRADITIONS

Mariner's Menu is Coastal Legacy

By Sarah Friday Peters • Photos by Scott D. Taylor

As the Seafood Lab clock's hands inch toward 9 a.m., Joyce Taylor bustles around the well-stocked kitchen checking last-minute details prior to a new Nutrition Leader session.

Before she hands out the six recipes they'll be testing, she checks in with the women who over the years have become more than coworkers — they are close friends.

"We've got handouts. Remember I used to be a teacher," jokes Taylor, now-retired North Carolina Sea Grant seafood expert, as she passes out the day's recipes and rating sheets.

Like a well-trained team, the seasoned cooks, donned in "Eat More Seafood" aprons, divide the recipes from their coach, and begin pulling ingredients out of large wooden cabinets and packed refrigerators.

Since 1973, representatives from each Carteret County home extension club have gathered monthly to test new ways of handling, storing and preparing fish and shellfish caught off the North Carolina coast.

First known as the "Health, Food and Nutrition Leaders," these cooks came, cooked, then shared what they learned with their own clubs back home in Crab Point, Gloucester, Emerald Isle and other spots along the Crystal Coast.

Sea Grant and the North Carolina State University Seafood Lab started the program as a way to promote North Carolina seafood products. Then, as now, its purpose was twofold: to provide a place where good cooks could test seafood-related research, and to translate that information to the public.

"Home-grown and home-prepared," David Green, director of the Seafood Lab, describes the one-of-a-kind program. "It's North Carolina seafood products prepared by North Carolina people."

What makes the Nutrition Leaders' program even richer, he adds, is that women who joined in the 1980s are the "newcomers." For 30 years, the program has sailed along with Taylor at the helm.

Now, their legacy will endure with *Mariner's Menu: 30 Years of Fresh Seafood Ideas*, published this fall by Sea Grant.

Mariner's Menu contains more than 160 of the Nutrition Leaders' top-rated recipes, such as *Sautéed Soft Crabs with Fresh Lime*, *Carolina Shrimp Boil* and *Scallop Bisque*. Chapters cover such cooking methods as broiling, grilling, frying and steaming the catch.

Yet, *Mariner's Menu* is more than a cookbook, as Taylor is quick to point out. It's

Continued

a complete seafood resource book for people who want to know more than just how to bake or fry fish.

More than 50 detailed illustrations by Morehead City artist Connie Mason add to the book's down-home flavor, as well as scenic photos by Beaufort photographer Scott D. Taylor.

Joyce Taylor, herself, grew up in the Blue Ridge Mountains, but moved to Carteret County to teach in 1954 and now claims the coast as home. She taught various grades before taking a job at the Seafood Lab in 1974, all the while slipping out in her boat and casting a line when she could.

In the Lab

For each cooking session, Taylor selects recipes ahead of time, gathers ingredients and buys the fish. Today, it's 12 pounds — bought fresh the day before from a local fish market.

Recipes are timed so the dishes come out of the oven at different times. Taylor leaves notes on most of the recipes, like "Check the amounts of oil, butter." Or, "Check the amount of butter needed for sautéing."

"We've got to measure everything," says Dolena Bell of Beaufort. "She likes us to be absolutely correct in our measuring."

As the pairs cook away, Taylor checks in, offering suggestions, tasting, urging them to write down any important information. At one point, she asks everybody to stop and taste.

LEFT: **Mariner's Menu** *offers not only clam recipes, but also tips for transporting and opening shellfish.*
RIGHT: Fresh herbs are included in many of the recipes tested by the Nutrition Leaders.

"For 30 years, Joyce has spread the word on fresh North Carolina seafood — the distinct flavors, the nutritional value," says Ronald G. Hodson, director of North Carolina Sea Grant. "With her dedicated group of Nutrition Leaders, she offers traditional and nontraditional fare that consumers trust they can make and enjoy at home."

Taylor explains that seafood is not to be feared. "People have not been comfortable cooking seafood," she says. But after she demonstrates or shares a recipe from *Mariner's Menu*, people say, "It looks so easy, I think I can do it."

Part science class, part cooking show, the women work with a relaxed precision that comes only from time together in the kitchen.

For decades, Taylor urged seafood lovers to veer away from frying. "I preached it for years," she says, mainly for nutritional reasons. "But a book like this would be incomplete if it told you how to do everything but fry."

By 10:45, Betty Motes and Bell start to fry their flounder for *Crispy Flounder Fillets*. Judy Blessing drops four fillets in a pan of sizzling butter at the same time for her *Snapper Fillets Sautéed with Mushrooms*. Taylor gives a short lesson on clarifying butter.

Fifteen minutes later, Taylor and most of the Nutrition Leaders begin tasting *Deep-fried Shrimp*.

By 11:15, the third dish is up — piping hot *Mahi Mahi Sautéed in Butter*. The room falls silent as the group, now burgeoning with coworkers from down the hall, savors the dish.

"Well it's cooked to perfection. It's as moist as it can be," Taylor comments. "We should have used skinless fillets."

Within minutes, Valaree Stanley and Vera Gaskins are back at work, dredging and draining firm white triggerfish fillets.

Next comes *Grouper Fillet in Beer Batter*. Again a hush fills the room, and the Nutrition Leaders fill out their rating sheets, ranking recipes from 1 to 5, which is "excellent." Only recipes with 4.5 or higher will make it into *Mariner's Menu*.

Just before noon, Stanley presents a platter of steaming hot, golden-fried triggerfish like a proud chef offering a succulent Thanksgiving turkey. Tasters in the now-crowded room line up with paper plates and plastic forks waiting for a bite with a dollop of homemade tartar sauce.

No one's disappointed.

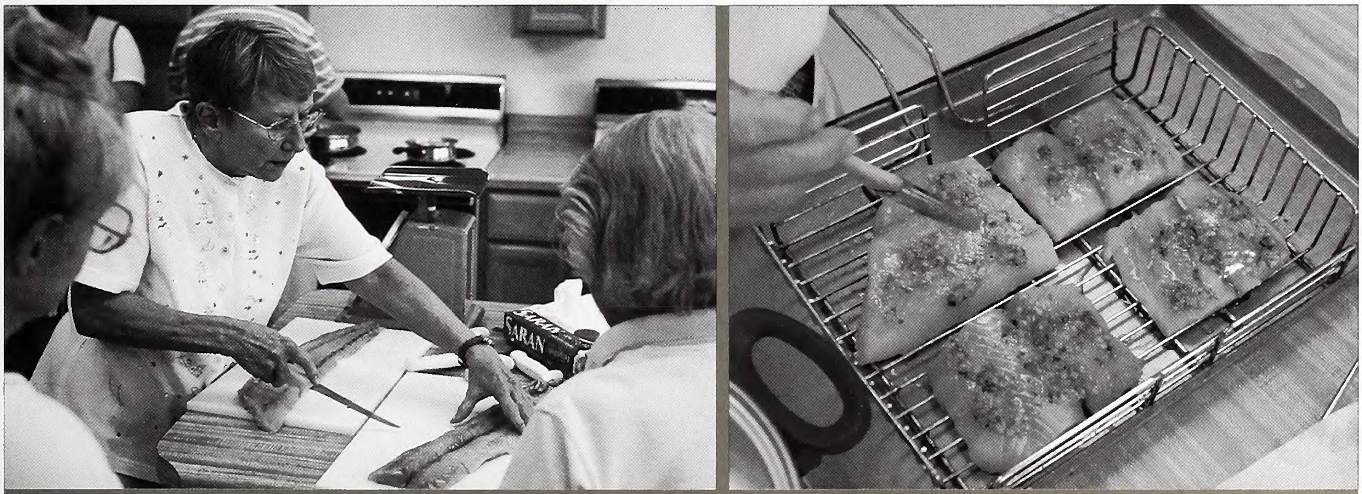
Within minutes, countertops shine, the spices line the shelves again, the dishes are washed and put away. And the Nutrition Leaders chalk up another successful session.

"I believe I've eaten about a pound of fish today," Gaskins says.

"Yes," adds Lissie McNamee, "We eat and go home happy."

Meet the Nutrition Leaders

Each of the Nutrition Leaders brings a special flavor to the table. Over the years, more than 50 volunteers have supported Taylor's Sea Grant efforts, including a *Mariner's Menu* newsletter, and various workshops and publications.



LEFT: Joyce Taylor cuts portion-size pieces of a fish filet to be used in a recipe that will be tested for the seafood resource book. RIGHT: Learning techniques for handling and preparing takes the fear out of seafood cooking. Rule number one: Only the freshest fish will do.

"Their contributions are remarkable. The work — the book — would not exist without the Nutrition Leaders," Taylor says.

Even after Taylor retired, these 11 women continued the monthly tradition to complete chapters of the book — and some still return monthly for a Seafood Lab project focusing on aquaculture species.

Dolena "Dolly" Bell

The youngest of five Gillikins, Dolena Bell grew up on a farm eight miles east of Beaufort in a little community called "Bettie."

Back then, all the neighbors would tie their nets together each fall when the mullet ran, build a fire in the sand and have a fish fry. In winter, she and her mother often would go down to the water to gather oysters, then roast them on the shore or back home. She recalls gathering scallops, too, then selling them by the bucket in her side yard.

Yet even with all she knew about fish, Bell says she's learned much at the Seafood Lab since joining in the early 1980s. "North Carolina seafood is hard to beat," she says. "We were blessed."

Judy Blessing

Cod and canned tuna were about the only fish dishes on Judy Blessing's menus before moving South. "Being from a Catholic family, I can remember eating fish every Friday," recalls the Athol, Mass. native. "We only had cod with tartar sauce or tuna casserole. Nothing fancy."

All that changed when she married and moved onboard a 32-foot sailboat, *Moon Mist.* For six years, the newlyweds toured the world, docking in Beaufort for good in 1983.

"Sailing for six years we caught lots of different fish" like lobster and squirrelfish, Blessing says. But joining the Nutrition Leaders in 1985 finally helped her learn a variety of ways to cook and enjoy fresh seafood.

Vera Gaskins

Marrying a weekend angler in 1961 brought Vera Gaskins abruptly, but willingly, into the world of cooking seafood.

"He loves the sport, and I have always tried to use his catches to feed our family," says Gaskins, a native of Alabama. Her sister-in-law passed along a few frying tips, but for years Gaskins relied on two dog-eared seafood cookbooks before becoming a Nutrition Leader in 1982.

Before then, Gaskins fried 90 percent of the seafood she cooked. Now the former Emerald Isle mayor bakes, grills, microwaves, stews, steams and fries. "I'm not afraid to experiment and alter recipes, and I no longer shy away from cooking seafood for a crowd."

Martha Giles

"I don't really remember 'learning' to cook," Martha Giles says. "We just did it, I guess, from helping Mother," back in her Chadboume kitchen in Columbus County.

Growing up close to the ocean, "We cooked a goodly amount of seafood, especially fish and oysters," Giles recalls.

Marrying a fisherman — and a good cook himself — kept Giles near the bounty of the sea.

Continued

And joining the Nutrition Leaders around 1985 opened her eyes to the possibilities and potential of seafood.

"First is fresh, fresh, fresh," she says. Fresh ingredients and fresh fish and shellfish taste better. "Also, that seafood can be cooked many different ways."

Kay Holm

Squid. That was the first seafood ingredient Kay Holm was introduced to as the newest Nutrition Leader one day at the Seafood Lab in the early 1980s. "I looked at it and thought, ooooooh. But it was darned good!" says the long-time Merrimon resident.

The Los Angeles native always has loved seafood and loved to cook. She grew up by the apron of her Armenian mother, watching her craft pilafs, stuffed grape leaves, and of course, her sweet, light baklava.

Holm moved to Carteret County in 1975. "Back then, I cooked seafood the way everybody did — I fried it." But after joining the Nutrition Leaders, Holm learned about other species besides squid, how to use herbs and spices, and new ways to cook and entertain with seafood.

Anne Lawton

When it comes to creating things, Anne Lawton's hands can work magic. Whether working behind a kitchen counter or a craft table, Lawton could turn a few scraps of cloth into a pretty quilt or a handful of ingredients into a mouth-watering dish.

"She had this big metal tin that she mixed the fruitcake in," her daughter recalls. Those fruitcakes tasted unlike any you could buy. Then there were her crab cakes, homemade bread and caramel cakes, too.

One of five children to grow up on a farm outside Summerville, S.C., Anne Smith married an Army man in 1939, moving around the world and rearing five children before retiring to Carteret County in 1968.

Two decades as a Nutrition Leader led Lawton to cook more seafood for friends, family and her home extension club, her daughter says. "Everything she made was delicious."

Lissie McNamee

"I have my own gill net — 50 feet long — three crab pots and a row boat," says Lissie McNamee of Merrimon. "It's just enough for me to go out there and catch a few mullet when I can on Cedar Creek off the Intracoastal Waterway."

The cheery cook grew up on a farm near Wilson Mills. The sixth of seven children, she learned basic cooking skills helping out in the kitchen. But before joining the group, McNamee had never cleaned a crab or filleted a fish. "I really only knew frying," she recalls.

She had the good fortune to marry a commercial fisherman who caught, cleaned and cooked his own catch.

Joining the Nutrition Leaders in the late 1980s taught McNamee new ways to prepare their fresh-caught fare. Plus, over the years, she lost 50 pounds and gained good friends, tasty recipes and good health.

LEFT: Bamboo steamenrs are among the kitchen accessories suggested by Taylor and her team.
RIGHT: You won't find much filler in these individual seafood casseroles that drew top ratings.

Betty Motes

Like many coastal North Carolina families, Motes' mother and father farmed and fished, grew vegetables and raised hogs and chickens to make a living.

"My mother cooked fish at least once or twice a week," she recalls. "We went clamming in the summer and bought oysters in the winter. We caught our own hard crabs in the summer. ...

"We also canned fish roe, which we ate with eggs from our own chickens, for breakfast."

She married, keeping her roots near Harlowe. As the Motes' family grew, Betty began her own cooking traditions like conch stew and fresh-cooked hard crabs. But the ritual the Motes family will remember most is the annual holiday oyster roast with about 20 bushels of fresh Harkers Island oysters and 45 of their closest friends and family.

Mary Dudley Price

The seafood Mary Dudley Price remembers from her childhood in Tarboro and Raleigh came in cans or was salt-preserved. "Only oysters could be had fresh, and they were ladled out from large tins into quart and pint cardboard containers such as were used later to haul goldfish home from the store," says Price.

The only fresh fish she recalls from her early days were from trips her father took out of Morehead City with Captain Tony Seamon, long before he opened his now-famous Sanitary Fish Market.

Mary Dudley married Woodrow Price, a newspaperman and avid outdoorsman.

A journalist herself, Price somehow fit cooking fresh-caught fish in between writing and editing for North Carolina newspapers and magazines and rearing four children.

As one of the first on board with Taylor, Price learned how to pickle fish, can fish and smoke fish. How to skin eels and shuck a clam. And best of all, how to make the most of the ocean's bounty.

Valaree Stanley

Yes, Valaree Stanley knows seafood, after growing up on the Newport River and cooking the catch for more than 80 years in Carteret County. But she knows what tastes good after a hearty seafood meal, too. Cake.

The baby of 13 children, Stanley got her start in the kitchen at about age 7 or 8 by watching her mother and older sisters, especially Alice. Alice loved to bake cakes from scratch, even making her own butter, and to sell them at the Morehead City curb market, which opened in 1935.

Today, the vivacious cook still manages the local curb market, the longest continuously operating one in the state, as well as volunteers in countless other endeavors. But as in the past, there's always time for seafood and her beloved Nutrition Leaders, which she joined in 1985.

Dorothy "Dot" Whitley-Overton

"Daddy was a fishing and hunting man," recalls Dorothy "Dot" Whitley-Overton. "Mother canned fish and anything else that we could use. My bedroom looked like a grocery store" with Mason jars full of meats, fish, beans, potatoes and other vegetables from the family farm near Havelock.

As the oldest of five children, Whitley-Overton learned to cook by her mother's and grandmother's sides. She recalls feasting on stew fish and fish cakes, and getting to go crabbing with her daddy on Saturday if she finished her chores.

Then, "I married a man who was part cat," she adds. "Fried fish one day. Two days later it was stewed fish."

In the 24 years she's been with the Nutrition Leaders, she's learned how to cook crabmeat and other kinds of seafood, safe-handling tips, and that freshness is the key.

"Joyce has been the best teacher," Whitley-Overton says. "It has been a joy."

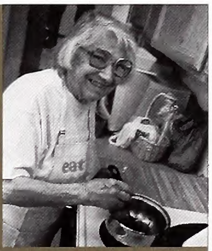
Joyce Taylor

"Dolly" Bell

Judy Blessing

Vera Gaskins

Martha Giles


Kay Holm

Anne Lawton

Lissie McNamee

Betty Motes

Mary Dudley Price

Valaree Stanley

"Dot" Whitley-Overton

To try a delicious recipe from Mariner's Menu, *see page 23. To order a copy of* Mariner's Menu: 30 Years of Fresh Seafood Ideas, *send your request and a check for $25 to North Carolina Sea Grant, NCSU Box 8605, Raleigh, NC 27695-8605. For Sea Grant office locations, call 919/515-2454. Also, this fall, check for the title at your local bookstore, thanks to distribution through UNC Press,* www.uncpress.unc.edu.

Taylor and team will be honored at a reception Sept. 29, 4-6 p.m. at the Center for Marine Sciences and Technology in Morehead City.

Striped Mullet:

VALUABLE FISHERY WITH RICH TRADITION

By Ann Green • Photos by Scott D. Taylor

While watching the breakers along Atlantic Beach last fall, Joey Frost noticed a purplish tint to the water. The ocean was packed tight with a school of striped mullet.

With the "stop net" that is designed to stop migrating schools of mullet in place, the beach seine crew pulled in the striped mullet with a farm tractor. All told, they hauled in more than 45,000 pounds of mullet.

"This was our largest catch in five years," Joey Frost says. "It was exciting to catch that many fish. It took six to seven hours to load the fish on the truck."

For the Frost family, beach seining is a ritual that has been going on for five generations. Now, Henry Frost, his son, Joey Frost, and grandson, Matthew Frost, work on the beach seine crew each fall.

"It is our heritage," says Henry Frost. "It was started by my grandfather. It is so much fun scoring mullet."

In 2002, the Frosts combined their operations with another crew on Bogue Banks, making them the only beach seine crew on the Banks. "It creates a great comradery when you have 25 men doing a job in unison," says Frost.

Along North Carolina's coast, there are also some small beach seine crews that fish for striped mullet off Cape Lookout.

Instead of using beach seines, most of the commercial fishing community is using gill nets to catch mullet during the fall. Both are targeting roe mullet — a delicacy in the Far East.

The meat, which is rich and tender, is used in rice noodle soup. The plump golden yellow roe is preserved and given as a gift in Taiwan during festivals and the New Year.

"In 1979, gill nets replaced beach seine as the dominant commercial fishery for all mullet," says Rich Wong, N.C. Division of Marine Fisheries (DMF) biologist. In 2001, 94 percent of the commercial mullet landings were from gill nets."

Besides stop and gill nets, recreational fishers use cast nests when fishing for striped mullet.

Mullet Regulations

For the crews that use stop nets, there are strict regulations. In the early 1990s, user conflicts arose between pier owners and beach seiners using stop nets, according to Wong.

As a result, the DMF began regulating stop net fishing for striped mullet. Stop nets may be used only in the Atlantic Ocean on Bogue Banks in Carteret County in certain areas between Beaufort and Bogue inlets.

Although the primary season for mullet is the fall, some people also fish commercially for nonroe mullet throughout the year.

Year-round mullet fisheries — coupled with the traditional fall gill net and beach seine fishery for roe mullet — have created a concern for the economically important species.

In 2002, the commercial fishing community landed about 2.6 million pounds of striped mullet, valued at $1.2 million, making it the sixth most valuable finfish in the state, according to DMF. From 1972 to 2001, Carteret County led the state in commercial mullet landings with an average of 43 percent, followed by Dare County with about 12 percent.

However, in 2002, the landings for Dare and Carteret counties were nearly equal. Carteret had 30 percent of the striped mullet landings, followed by Dare with 28 percent.

In Dare County, about 80 percent of the roe mullet come out of the Albemarle Sound in a four-mile strip between Manns Harbor and Manteo on the Croatan Sound, according to commercial fisher Charles Locke of Wanchese.

"There is a theory by old-timers that roe

Continued

mullet have their right eye to the shore when moving," says Locke, who uses gill nets to catch roe mullet. "So if you look at a fishing chart, mullet move south on the shoreline with their right eye." That may be why the fish come down the west shore of Manns Harbor, he adds.

For the commercial mullet fishery, 2002 was a banner year with 2.6 million pounds harvested, which is approximately 450,000 pounds higher than the average landings from 1994 to 2001, says Wong. "Gill net and beach seine landings each accounted for 88 percent and 10 percent of the total landings. Beach seine landings were the largest in 10 years," he adds.

To better manage the fishery, DMF began developing a mullet management plan in July 2002.

"In 1999, striped mullet was listed as a species of concern by the Division of Marine Fisheries," says Wong. "There was a lot of fishing efforts on the stock, and the landings were high."

Sea Grant/DMF Study

To estimate striped mullet mortality, North Carolina Sea Grant and DMF started a Marine Fisheries Fellowship Program in 2002.

"The fellowship is designed to bring new ideas from young scientists who receive experience in how a management agency works," explains Ronald G. Hodson, North Carolina Sea Grant director. "The mullet program fits perfectly."

For a year, fellow Nathan Bacheler analyzed data from 15,000 mullet tagged between 1997 and 2002 by DMF.

"The tagging data suggests that the striped mullet survival rate was between 15 to 30 percent," says Bacheler, who now is working on his doctorate at North Carolina State University. "It appears that the survival rate for adult fish is relatively low, but we are not sure if the high mortality rate is due to fishing or natural causes."

Bacheler also found that mullet, which live in both salt and fresh waters, remain inshore most of the year, except when spawning.

In late summer, striped mullet start migrating to coastal waters and southward. Spawning takes place between October and December in inshore waters. Then the fish migrate back northward and toward shore.

The fish are bottom feeders and either scrape off material from rocks with their spade-like lower jaw or pick up the material from the ocean floor with their gill rakers and teeth. Striped mullet spit out all other matter. They also feed almost exclusively during the day, with a diet of phytoplankton and other tiny marine forms, as well as dead organic matter. In turn, top predators such as birds, fish, sharks and dolphins feed on striped mullet.

Striped mullet also are highly prolific. A large female can produce upwards of 4 million eggs.

Mullet Fishing History

David Stick's *The Outer Banks of North Carolina* offers historical perspective:

...Writing from the Beaufort area in 1871, H.C. Yarrow had the following to say about mullet: "This species is the most abundant of the locality, and affords sustenance and employment to thousands of person on the coast of North Carolina.

"From the month of May, when small sized individuals appear, fishing continues during the entire summer... and frequently until November... . The numbers taken are simply enormous, sometimes as many as 500 barrels being secured at a single haul. It was estimated by competent observers that not less than 12,000 barrels of mullet were captured on the coast of North Carolina Friday, September 22, 1871."

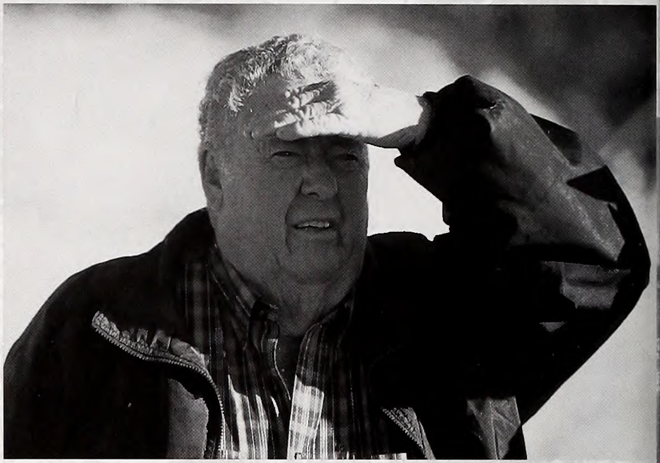
In 1880, R. Edward Earll conducted a thorough investigation and found that the majority of the mullet fishermen were farmers from the mainland.

"When the fishing season arrived," he said, "they leave their homes and proceed in gangs of four to thirty men to the seashore under the leadership of a 'captain,' who controls their movements... . On reaching the shore they at once build rude huts or cabins, in which they eat and sleep until the close of the season."

The men would post a lookout for mullet on the top of a large sand hill or a constructed lookout tower. When the men saw a school of fish, they would leave the post, walk down the beach and indicate the movements of the fish to other crew members with arm signals, according to Stick:

Finally, at the proper signal from the lookout, the fishermen would launch their boat through the surf, and 'shoot' their seine in front of the approaching school of fish.

After pulling in the schools of mullet, the men would take their catch by boat to fish houses.

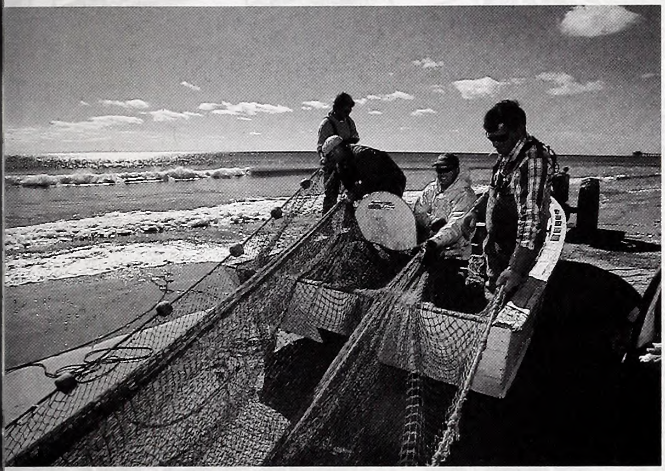


TOP: Veteran fisher Henry Frost checks out his crew on the water. BOTTOM: Two of the Frost crew look at the large catch of mullet. TOP RIGHT: The crew pulls in some stop nets. BOTTOM RIGHT: Beach seine crews use farm tractors to pull in the stop nets filled with mullet.

Beach Seining on Bogue Banks

During the turn of the 20th century, crews fished in the narrow point on the beach along Bogue Banks, according to Henry Frost. "In a run boat, the crews would take freight to Morehead City. One of the tote paths was Salter Path — that's how it got its name."

During the 1930s and 1940s, there were



seven beach seine crews on Bogue Banks, according to Frost. "They were all working for the federal Work Projects Administration (WPA)," that was set up under President Franklin D. Roosevelt's administration. "It was the only way people could find work," he adds. "Each crew had 10 to 15 men."

During this time, the crews often traded fish for meat. "I'd seen Daddy many times salt mullet and spot and trade for meat with a farmer," says Frost. "We were in paradise and didn't know it. You didn't worry about money then. You would fish to get enough money for kerosene."

By the time Joey Frost joined the crew in 1974, the Frosts had modernized their beach seine operation. Instead of pulling the nets in by hand, they used tractors.

Throughout the 1970s and into 1980, beach seine operations dominated the roe mullet fishery.

One of the Frosts' biggest catch was in 1974, when the mullet were so thick that you could see the fish two miles up the beach, according to Joey Frost.

"We had a hundred yards of bunt" that is part of the fishing nets to land the fish, says Frost. "Before we got to the beach, one tractor got pulled to sea," he adds. "It kind a scared us.

"The fish were getting tired and trying to swim offshore. We kept working against the high tide. We estimated that we got 110,000 pounds of mullet, but we probably got 130,000 pounds. When the tide fell, the fish were still thigh thick in the water."

To celebrate the mullet fishery, Swansboro holds a Mullet Festival each year. Begun in 1954 to celebrate the completion of the White Oak River bridges, the festival has changed from a community gathering to a regional event where fried mullet is served.

"This first year they threw a fish fry for workers on the bridge project," says Randolph Thomas, president of the Swansboro Festival's Committee. "The late Swansboro Police Chief M.T. Maness kept the festival going for more than 20 years. Over the years, the festival attendance has grown from several hundred town folks to more than 25,000 people."

During the 1980s, Henry Frost says he began to see a decline in the size of mullet caught. At this time, the price of fish per pound increased.

"When I first started fishing, the mullet were larger," says Henry Frost. "In 1980s, a lot of Florida fishermen started coming up here and targeting mullet. They used tower boats and fished at night. Before this, we used to beach seine at night."

With the ban of gill nets in Florida waters for black mullet in 1994, more commercial fishers from Florida began fishing in N.C. waters. At the same time, more North Carolina fishers turned to gill netting for striped mullet.

"It is not as expensive as haul netting and doesn't require a big crew," says Locke, who serves on the DMF Striped Mullet Advisory Panel. "I can go out with one man. It also is more mobile than haul netting. You go gill netting wherever the fish are. You never set a net until you see a school of fish."

Fall Fishery

Beach seine crews begin preparing for striped mullet fishery in September.

One day, Henry Frost's yard was piled high with fishing nets and machines. His grandson, Matthew Frost, was lubricating the tractor.

When the season starts, the crews are dependent on the winds blowing from the northeast to northwest to set the nets.

"You have to wait for a shifting wind or nor'easter to make the seas calmer," says Henry Frost.

When the wind begins blowing right, the crew sets the net. They go out in the water with a dory boat and use an anchor to set the net.

"We may set a net for three or four days and not catch anything," says Joey Frost. "It takes seven to eight people to set a stop net. When you do strike, the fish are so compact it is like wall-to-wall fish. You can get 60,000 pounds in one day."

To pull in the nets, the Frosts use a team of 10. "It takes 10 men in waist deep water to pull in a stop net," says Joey Frost. "The whole time, the sea is breaking."

After the fish are pulled in, they are put in baskets. Then men load the truck with fish and take the catch to market.

The money for the catch is divided evenly among the crew. "In 2002, we made only $2,500 apiece for the three-month season," says Joey Frost. "This is not a living. But it is like a working vacation."

The 49th Annual Mullet Festival will be held Saturday, Oct. 11, in downtown Swansboro. The parade begins at 10 a.m. More than 200 vendors will be showcasing their arts and crafts — from pottery and jewelry to birdhouses and blown glass. For more information, call 910/353-0241.

Science on the High Seas: The Oculina Banks Research Cruise

By Pam Smith

The crew retrieves the Remotely Operated Vehicle after one of 23 dives to determine how much of the rare Oculina varicosa *remains intact in the marine protected area. Is it enough to provide habitat for deepwater fish?*

Pam Smith

It's late afternoon when the M/V *Liberty Star* steams out of Port Canaveral, Fla. — past charter boats in from a day of Gulf Stream fishing, and on past commercial fishing vessels draped with nets still wet from hoisting the catch-of-the-day.

The determined pace means *Liberty Star* — a NASA space-shuttle support ship — will reach its destination 30 miles offshore well before the sun slips below the horizon.

Topside, Andy Shepard thinks out loud. "There's plenty of daylight for a launch."

But this launch won't generate a deep-space probe.

On the contrary. His crew will launch an array of high-tech instruments to explore the deep-ocean realm of the Oculina Banks — the only known deepwater reef in the world formed by *Oculina varicosa,* or Ivory Tree coral. This pure-white oddity grows in mounds and pinnacles along the edge of Florida's continental shelf, below the Gulf Stream Florida Current at depths of 200 to 300 feet.

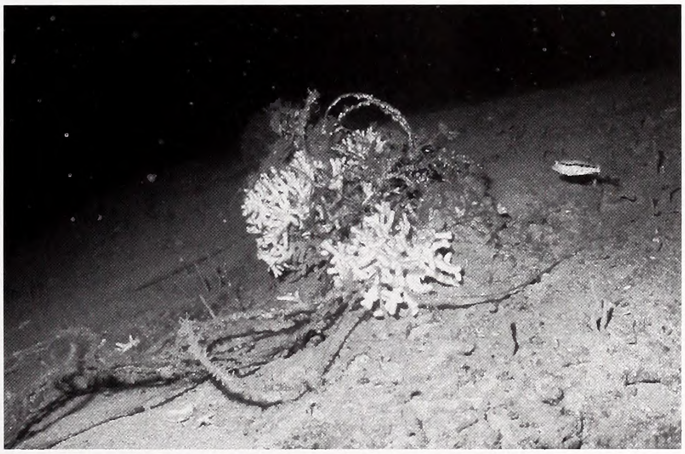
Shepard, who is coordinating the 10-day scientific mission, is director of a National Undersea Research Center based at the University of North Carolina at Wilmington and funded by the National Oceanic and Atmospheric Administration (NOAA).

He has assembled an interdisciplinary team of researchers, technicians, students and observers from a number of organizations. They will help document the status of the coral habitat and fish populations in the 300-square-mile Oculina Habitat Area of Particular Concern (OHAPC). A 92-square-mile segment of the offshore formation first became a Marine Protected Area (MPA) nearly 20 years ago.

Scientists fear that much of the unique coral reef ecosystem continues to be reduced to rubble, mainly from bottom-fishing activities.

The 2003 Oculina expedition is the latest in a series — largely sponsored by NOAA Fisheries — designed to produce scientific data to support sound habitat protection and fisheries management decisions.

Ocean research is costly, and the NASA partnership stretches limited research dollars. NASA provides a state-of-the-art ship as a platform for operations at sea, as well as a highly trained crew to launch and maneuver undersea research technologies. NOAA's Remotely Operated Vehicle (ROV) and NASA's Passive Acoustic Monitoring System (PAMS) will enable researchers to "see and hear" ocean floor activities.



ABOVE: A stand of Oculina varicosa *coral is wrapped in long-line. Pieces of cable, nets and trawls 'seen' on the reef by the ROV testify to illegal bottom-fishing activities.* Photo courtesy of NOAA/NURC

Ongoing quest

Much of what already is known about Oculina Banks is the result of decades of research by John Reed, chief scientist on the mission and at Harbor Branch Oceanographic Institution (HBOI) in Fort Pierce, Fla. In 1975, scientists there discovered the rare coral reefs.

Soon after, Reed began studying Oculina Banks. He described live coral thickets, mounds and pinnacles up to 30 meters high and teeming with life. Reed recorded a healthy ecosystem supporting 250 species of mollusks, 50 species of crabs and shrimp, and some 70 species of fish — including various grouper, snapper, black drum, porgies, sea bass, amberjack, angelfish, sharks, rays and small reef fish.

Continuing studies demonstrate steady declines in both live coral and fish populations — despite having federal protection since 1984.

That's when NOAA Fisheries' South Atlantic Fisheries Management Council designated a 92-square-mile area as the OHAPC — an MPA classification that called for close monitoring and banned the use of bottom-tending gear such as trawls, dredges and fish traps.

Subsequent research by HBOI's Grant Gilmore and Florida State University's Chris Koenig showed dramatic loss of fish populations, primarily grouper and snapper.

So, in 1994 the council classified the area as the Experimental Oculina Research Reserve for a 10-year period to protect the coral habitat and dwindling snapper and grouper populations in the reserve.

Then, in 2000 the council expanded the OHAPC to encompass 300-square miles — about 60 nautical miles long and 5 nautical miles wide — stretching from Cape Canaveral to Fort Pierce.

The moratorium on hook-and-line bottom fishing for all snapper and grouper species applies *only* to the 92-square-mile experimental research reserve. The larger area remains off-limits to bottom trawls, dredges, fish traps and anchoring — but commercial and recreational fishers may surface troll for pelagic fish, such as wahoo, tuna, dolphin and sailfish.

The goal is to protect the rare coral and fish habitat, and assist in the management of important commercial and recreational fisheries.

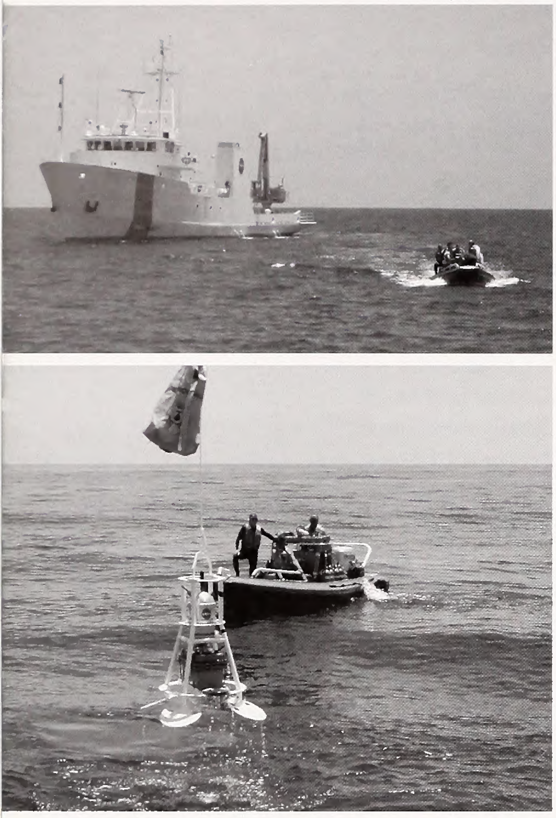
Life as a coral

Corals are primitive animals made up of colonies of polyps. Unlike their shallow-water reef cousins, the deep-water species, such as *Oculina varicosa,* lack symbiotic algae, or *zooxanthellae*, to supply nourishment and color. Instead, tentacles that encircle their miniscule, soft bodies capture plankton carried by deep-flowing currents for food and energy.

The *Oculina varicosa* corals secrete limestone, expanding their branch-like skeletons as they grow upward, ever-so-slowly, at a rate of about one-half inch per year, building the reef as they go. A five-foot coral "tree" may be a century old.

Continued

Photos courtesy of NOAA/NURC



TOP: Scientists shuttle to and from NASA ships that serve as platforms for part of the 10-day operation at sea. BOTTOM: NASA divers prepare to deploy the Passive Acoustic Monitoring System unit — one of three that will listen to ocean floor activities for three days and nights.

Simple as it is, coral is the keystone of complex ecosystems.

Rock shrimp, a prime commercial target in Florida, are attracted to the nooks and crannies of coral reefs for food and shelter. During their migratory journeys, pelagic fish, such as tuna, feed on baitfish associated with reefs. The Oculina Banks are a well-known breeding site for many species of snapper and grouper. Less migratory, these fishes stay closer to home, and thus rely on the reef's baitfish for sustenance for much of their long lives.

Oculina Banks — with its branching coral clusters and limestone shelves and ledges — has provided critical habitat for marine life for millennia. About 90 percent of the *Oculina varicosa* has been damaged or destroyed during the past two decades, Koenig's research shows.

The mission will use a three-dimensional map of the reserve bottom made using multi-beam sonar during a 2002 cruise on the NASA ship. The ROV dives will be used to "ground truth" the map, Reed says. This will establish important baseline scientific data that can be used to track future changes in the Oculina Banks ecosystem.

A sense of urgency

On board *Liberty Star*, there is a sense of urgency to get on with the mission.

The research team is anxious to make up for time lost returning to port to retrieve parts for the ROV disabled during a first-day dive. Repairs are completed just as the ship approaches Oculina Banks.

On the bridge, Shepard and Reed review charts and pinpoint dive coordinates with Capt. Bren Wade and First Mate Walt Adams — members of the United Space Alliance crew whose usual contract work with NASA involves retrieving space-shuttle rockets at sea.

For this operation, the crane operator lowers the tethered ROV into the sea until it hovers just above bottom. All the while, the captain maneuvers the ship against the strong current that flows at two to three knots, allowing the ROV to "fly" along the bottom at one-half to one knot.

In all, 23 ROV dives are scheduled, involving criss-cross sweeps over each site. The list includes sites not seen for 25 years. The ROV also will peer into unexplored areas inside and outside the reserve.

The launch begins. Shepard watches until the ROV disappears into the waves, then slips through the hatch to join Reed in the control room. There, Lance Horn is at the monitor, ready to "pilot" the ROV across the site.

Thrust engines roar. The monitor flickers the first glimpse of the reef transmitted from the ROV video camera. For the next tense hour, Horn — in constant communication with the bridge officers and the crane operator — controls the depth, pitch and yaw of the robot; points the video camera; and illuminates reef features and marine life.

Seated in front of the console, Reed and Shepard are joined by Robert Brock, a fish biologist from NOAA Fisheries headquarters in Silver Spring, Md., and Stacey Harter, a fish biologist from NOAA Fisheries in Panama City, Fla. The team will identify, videotape and photograph reef characteristics and fish populations.

Lights, camera, action

It's an intense "I Spy" video game. A feature comes in view, and one scientist calls out a general term. Another adds to the description, and so on.

Occasionally, they spot a cluster of live *Oculina varicosa* in areas where it had not been recorded before.

"Nice, John! We found more," Shepard exclaims at one unexpected sighting.

And so the ROV dives go, with peaks of excitement at spotting an artificial reef ball with intact, live coral and a couple of grouper swimming in and out of the igloo-like structure.

Spirits plummet at seeing clusters of half-dead coral, wrapped with long-line.

The coral, as fragile as china, is no match for the sweeping action of bottom-fishing equipment — a reality brought home as the camera reveals the bottom littered with broken coral debris. Two decades ago, Reed recorded healthy stands of *Oculina varicosa* in many of the same areas.

More disturbing, perhaps, is what they *do not* see. They do not see formations of live coral the size of Volkswagen Beetles that Reed described in the mid-1970s. Nor do they see large congregations of grouper, snapper, or black drum, once in abundance on Oculina Banks.

Reed, who has logged countless dives from a Harbor Branch submersible, remembers a time when the area was thick with curious fish.

Once, a caliper he was using to measure coral growth got the attention of a 300-pound Warsaw grouper. The fish swam closer and surprised Reed by snatching the caliper from his hand. The monster quickly retreated, then stopped to see if Reed was following. Reed recovered the caliper and went back to work, only to have the playful Warsaw grouper return for another round of "take away."

"He was like a giant Labrador retriever," Reed recalls.

Sadly, on this trip, ROV eyes do not spot a single Warsaw grouper.

A full agenda

The mission is carefully orchestrated. Each day, new people are shuttled out to the *M/V Liberty Star* to observe the scientific mission for a day. The roster includes resource managers, fish biologists, educators and journalists.

The mission is receiving positive regional media exposure, just as Shepard hoped.

He believes that education and outreach should be integral components of research projects, especially ocean exploration. How else, he asks rhetorically, can the public begin to understand a realm of life that they cannot see?

Earlier in the mission, NASA media specialists facilitated a live webcast. Leslie Sautter, director of NOAA's Project Oceanica at the College of Charleston, hosted three, one-hour segments. Each ended in a question and answer session, with mission team members answering electronic queries from students on the mainland.

Dewey Golub, Oceanica's educator-writer and Web specialist, posts daily logs and images from the mission on a dedicated Web site, *www.oceanica.org.*

The Oculina Banks research demonstrates that marine science is a very integrated discipline, Sautter says.

Sautter, a geologist and educator, is directing the collection of sediment samples. An apparatus is lowered from the ship to scoop up sediment from various sites. She will analyze the samples with Cathy Scanlon, of Woods Hole Oceanographic Institution, in search of tiny shelled zooplankton called forams.

"We will be looking for a genus that dominates each environment. We expect that they will be very different from site to site," she says. A map plotting the results will become part of the baseline data on Oculina Banks. Shifts in predominant genera could be environmental indicators, she says.

Jumping hurdles

Even the best-planned mission can present unexpected hurdles. The ship develops problems, and the entire cohort transfers to M/V *Freedom Star*, a NASA sister ship maintained by United Space Alliance.

The ROV floods two additional times. But, frantic repair work keeps the dive schedule on target, ensuring enough time to test the PAMS technology. For that, the ship steams out of reserve to an area near Sebastian Inlet at more shallow ocean depths.

Without a hitch, NASA divers position three PAMS units on the bottom, about 100 feet apart. Gilmore, now part of the Dynamac/NASA research team, helped develop the technology to monitor shuttle launch noise in the lagoons and wildlife refuge surrounding the Kennedy Space Center.

Now, for two days and nights the units will listen and record fish sounds — each with a distinct voiceprint. The black drum lives up to his name, producing the steady beat of a bongo drum. Other fish sounds are not as recognizable to an untrained ear. Gilmore and colleagues will analyze the recordings.

Like humans, most fish make sounds during social interaction. Distinguishing spawning males calling to females is valuable for fishery management decisions, Gilmore explains. It is critical to know when spawning occurs in order to protect the fishery.

"If they don't live long enough to spawn, there will be no fish," Gilmore says.

Mission accomplished

With all objectives met, Shepard and Reed can safely say, "Mission accomplished." In 10 days, 23 ROV dives produce 40 hours of underwater videotape and 2,000 digital still shots to add to the accumulating scientific data.

The images also provide convincing evidence of illegal fishing activities in the OHAPC. Enforcement, they say, clearly is an issue for the fisheries council to tackle.

The scientists welcome the news that the South Atlantic Fishery Management Council is recommending that the Department of Commerce continue the ban on bottom-gear in the *original* 92-square-mile research reserve until 2014. The closure of this segment within the larger OHAPC was scheduled to sunset in 2004 if not renewed.

In addition, NOAA Fisheries Law Enforcement promises to step up efforts in the closed area. A vessel-monitoring system may be deployed on shrimp trawlers in the region.

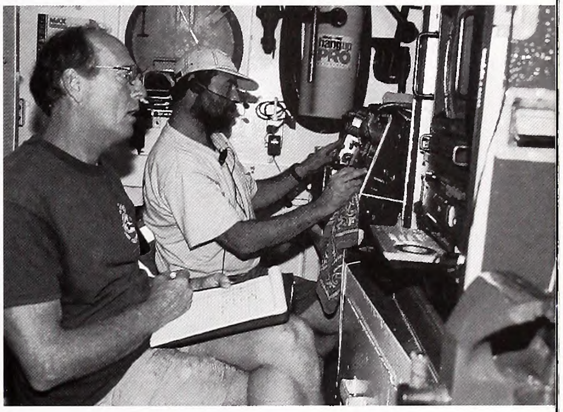
Reed, Shepard and Koenig submitted scientific data from the 2001 research mission prior to the fisheries council meeting taking up the reserve status.

Koenig joined 60 others expressing opinions in person. Speaking out, he says, helps give the scientific point of view public exposure and underscores the ecological value of Oculina Banks.

Public exposure of Oculina Banks is critical. If no one knows about it, no one can respond to the need to continue its protection, he says.

Perhaps media attention to the 2003 mission was a factor. But, Koenig was pleasantly surprised to hear support for the experimental reserve from many in the commercial fishing arena.

Photos by Pam Smith



TOP: Robert Brock, John Reed and Andy Shepard check coordinates for ROV dives on Oculina Banks. BOTTOM: Reed and Lance Horn intently watch the monitor as the ROV flies over the deepwater coral reef to document the status of the coral habitat and fish populations.

"They are beginning to understand that an MPA makes a good neighbor — especially in the Gulf Stream, where strong currents can carry the larvae of spawning fish well beyond MPA boundaries," says Koenig.

This understanding, Shepard adds, can and should provide a scientific foundation for selecting future marine protected areas. Six of the council's candidate MPA sites, like the Oculina Banks, are on the high seas, beneath the Gulf Stream. ◘

Look for an upcoming publication focusing on Marine Protected Areas. This MPA primer — meant to contribute to productive regional discussion — is a collaborative effort by the North Carolina, South Carolina, Georgia and Florida Sea Grant programs.

To learn more about Oculina Banks and MPAs, go to: www.uncwil.edu/nurc, www.oceanica.org, *and* www.mpa.gov.

The South Atlantic Marine Fisheries Management Council is expected to hold a series of public meetings later this year to consider candidate MPA sites in the region.

THE
CATCH

Angling for Fun:
Surf Fishing Tournament Promotes Catch and Release

By Ann Green
Photos by Michael Halminski

A judge measures a fish caught during the Cape Hatteras Anglers Club's surf fishing tournament in 2002.

It's a windy, fall day on the Hatteras Island beach as Brian Brown stands in ankle-deep surf.

Dressed in a one-piece camouflage chest wader, Brown casts his fishing line into the Atlantic. As he reels in a small bluefish, his fishing buddies cheer him on. "Go baby go," yell Brown's team members.

Brown takes the fish off the hook and gives the fish to a judge to measure. For the 11-inch bluefish, Brown scores one point in the Cape Hatteras Anglers Club's 45th Annual Invitational Surf Fishing Tournament.

There is no size limit on bluefish in North Carolina, but there is a bag limit.

"I was hoping to get two points," says Brown, who lives in Alexandria, Va. "I just found a good luck charm. It is a love note from my 13-year-old daughter saying to have a great trip. She forgot to call me and wish me good luck. So she hid the note in my waders."

The surf fishing tournament, sponsored by the Cape Hatteras Anglers Club, promotes catch and release for all fish caught.

"Fish shall be measured and released alive, unless the angler wishes to keep the fish for eating," according to the tournament guidebook. "Fish should be released by the judge."

Across the state, many sportfishing groups are promoting catch and release for species such as red drum, which carries a bag limit of one fish per day and a slot limit, or size restriction, of 18- to 27-inches.

Catch-and-release methods also work with other species, including tuna, king mackerel, striped bass and bluefish.

Done promptly and properly, and with the right equipment, fish sustain minimal injury and stress — and swim away for another day.

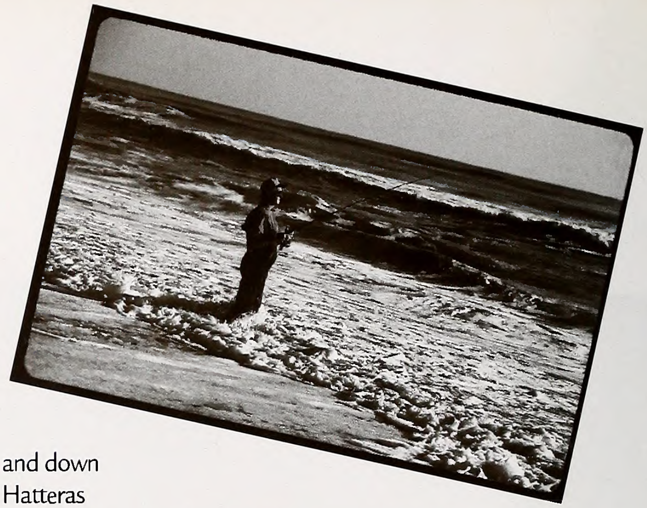
Red Drum Survey

Recently, North Carolina Sea Grant and the N.C. Division of Marine Fisheries (DMF) conducted a survey on habits of 456 recreational anglers who fish for large adult red drum.

From the survey, the researchers found that 56 percent of the anglers always use circle hooks when catching mature red drum. Another 27 percent sometimes use circle hooks. Studies show that fish are less likely to swallow circle hooks than the traditional J-hooks.

"The survey shows that already a lot of anglers use circle hooks," says North Carolina Sea Grant

Continued



ABOVE: The Hatteras Island beach was lined with tournament participants. RIGHT: A surf fisher waits for a tug on his line.

recreational fishing specialist Jim Bahen. "Fishery Resource Grant studies show that circle hooks are effective in reducing fish mortality." Sea Grant administers the FRG Program.

In 1999, saltwater anglers in North Carolina spent $170 million on trip expenditures and $1.4 billion on durable goods for a combined total of $1.6 billion, according to John Whitehead, an economist at the University of North Carolina at Wilmington.

"Although the exact number of saltwater anglers is not known in North Carolina, surf fishing seems to be growing in popularity," says North Carolina Sea Grant Extension Director Jack Thigpen.

Many recreational anglers participate in fishing tournaments. In 2002, more than 50 saltwater fishing tournaments were held in North Carolina — including the Big Rock Blue Marlin Tournament in Morehead City and the Pirate's Cove Billfish Tournament in Manteo.

"The number of saltwater fishing tournaments has doubled in the last 10 to 12 years," says Randy Gregory, DMF marine biologist.

Founded in 1957, the Hatteras tournament is one of the largest surf fishing tournaments of its kind in the world and the second oldest fishing tournament in North Carolina. The oldest tournament is the Nags Head Surf Fishing Club Tournament.

In 2002, 100 teams from up and down the East Coast participated in the Hatteras tournament, so popular that it has 66 teams on the waiting list, according to Sue Glass, executive secretary of the Cape Hatteras Anglers Club.

Kevin Deneen of Wilmington had to wait 13 years to get in.

"You have to wait for the team members to die," says Deneen.

The Hatteras Surf Fishing Tournament is a four-day event. Before members start fishing, they participate in numerous activities at the fishing club that is housed in a white building in Buxton.

A sign proclaims: "Welcome ye who go down to the sea in boots." Lists with names of fishing teams are posted on the hall wall, including "Surfside Anglers," "Six Aces," "Rod Runners," "South Jersey Surfacasters" and "Slammin Sammy's Hurricanes." Daily totals also are posted during the tournament.

Before the tournament starts, the members gather in a large room where they socialize, participate in auctions, view new fishing equipment and draw for tournament stations that determine where they will be fishing.

"It is all volunteers," says Gary Oliver who lives on the Outer Banks. "This is my 33rd year to be in the tournament. It started out with 30 to 40 teams and grew from there to 100 teams with 6 people on each team."

Fourteen of the 100 teams are all women.

"I have been in the club for eight years," says Ferol Drust, a "lady angler" from Frisco. "I like the excitement of not knowing what is on the other end. I also like being outdoors."

TOURNAMENT RULES

For the fishing tournament, there are strict rules. No cast nets or chumming — tossing ground bait in the water to attract fish. Also, the participants can't use a stringer or line on their belts.

Fish on stringers can attract sharks, according to Larry Hardham, president of the Cape Hatteras Anglers Club.

In addition, members may not have more than one line in the water at a time. When fishing, a nonteam member cannot assist the anglers in any way. Anglers must do all the work.

Points are awarded according to the size of fish and species.

The team competition lasts two days and consists of a morning and afternoon session. Each team is assigned stations — two areas on the northern beach of Hatteras Island and two on the southern beach.

"Every group gets to fish at low and high tide," says Hardham. "We try to make the tournament enjoyable for everyone, and apparently we are."

During one morning session, participants and judges arrive on the beach before 7 a.m. in their sport utility vehicles and trucks. The sessions run three hours in the morning and three in the afternoon.

To ensure the prompt release of fish, 75 volunteer judges drive along the beach in trucks or vehicles with orange flags. As fish are caught, the judges measure them.

As Art Beckwith of Kitty Hawk casts his line into the surf, he says that all he is catching are bluefish.

"I am using fresh mullet as bait," says Beckwith. "Bluefish are biting the best."

Once you cast your line, he says it is "even chances for everybody."

"Skill is not all that important," he says. "Ninety percent of the fish caught are within 20 yards of the breakers." Further down the beach, some anglers are catching red drum.

Kevin Greaves of Ocean City, N.J., pulls in a red drum that is 26.5 inches long.

"I have been in the tournament since 1996," says Greaves. "It is good for the mind and soul. You forget all other problems." ▣

Seafood Appetizers:
Fresh from the Start

By Joyce Taylor • Photos by Scott D. Taylor

Editor's Note: To celebrate the publication of **Mariner's Menu: 30 Years of Fresh Seafood Ideas,** ***we begin an occasional series of excerpts from the book. To start things off: Appetizers.***

Continued

When hosting a big party, a small dinner or a casual or formal gathering, let seafood be part of your menu.

You can serve a diverse selection of appetizers when you use seafood. And since many seafood preparations are light, your guests can enjoy them and still look forward to the main course. Or you can serve a selection of seafood appetizers with other foods such as raw vegetables, crackers and fruit for lunch or a light evening meal. Our appetizers easily convert to full meals. Baked Oysters with Bacon, *for example, makes a great main course. Just allow for larger portions.*

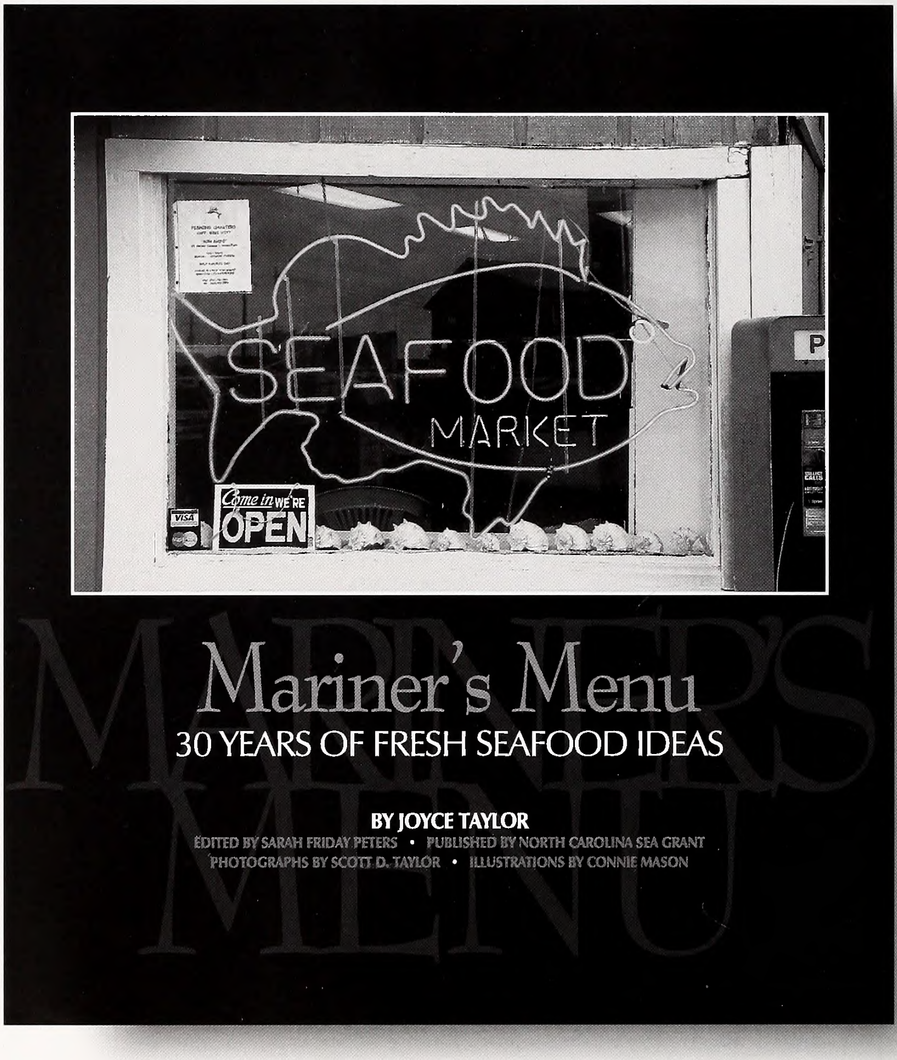
For large groups, plan to have mostly cold appetizers, with only a couple hot ones. Then you can enjoy your guests and spend minimal time in the kitchen.

Many popular publications contain recipes for seafood appetizers. But I find that many of the recipes are complex and not well tested. Plus, some are time-consuming to prepare, and when complete, often do not taste as good as the descriptions make them sound.

We've found that some of the simplest appetizers taste best. Simplicity also shortens preparation time. And many of the recipes, such as cold spreads and dips, can be prepared ahead of time. In fact, they often taste better when made a day before serving.

Canapes — toast or bread topped with spreads — make popular appetizers. Use fish or shellfish and vary the base. Our Flaked Fish Salad *can be used as a spread on thin toast, crackers, wafers or toasted or plain bread. Most of our dips and spreads can be used this way, too. Assorted breads such as white, rye, whole wheat and oatmeal add extra flavor and interest.*

Fish and shellfish appetizers add elegance and variety for holiday get-togethers, too. Our Shrimp Christmas Tree, *for example, is easy to make and offers a light, tasty alternative to the heavy foods and calorie-ridden sweets that abound during the holiday season.*



Mariner's Menu
30 YEARS OF FRESH SEAFOOD IDEAS

BY JOYCE TAYLOR
EDITED BY SARAH FRIDAY PETERS • PUBLISHED BY NORTH CAROLINA SEA GRANT
PHOTOGRAPHS BY SCOTT D. TAYLOR • ILLUSTRATIONS BY CONNIE MASON

CRAB-STUFFED SHRIMP

- 1 pound large shrimp
- 1/2 pound backfin crab meat
- 4 tablespoons melted margarine or butter
- 1/3 cup finely chopped celery
- 1/4 cup finely chopped green onion
- 2 tablespoons mayonnaise
- 1 teaspoon Tabasco sauce
- 1 teaspoon Worcestershire sauce
- 1/2 teaspoon salt
- 1/4 teaspoon freshly ground white pepper
- 2 slices fresh white bread, cut into cubes

Shell shrimp, leaving tails on. Split lengthwise until almost cut through, then spread apart in butterfly shape.

Remove any shell or cartilage from crab meat.

In 2 tablespoons margarine, lightly sauté celery and green onion in small saucepan. In medium bowl, combine mayonnaise, Tabasco, Worcestershire, salt and pepper. Add celery and green onion. Add bread cubes and mix. Gently stir in crab meat.

Stuff the butterfly shrimp with the crab mixture. Place on a lightly greased baking sheet and brush with the remaining 2 tablespoons margarine. Bake at 400° F until tops are lightly browned and shrimp are done, about 15 minutes. Serves 3 to 4. As an appetizer, serves about 10.

SHRIMP CHRISTMAS TREE

- 2 pounds medium shrimp
- 1 bunch curly endive
- 1 foam cone, about 1 1/2 feet tall
- 1 box small round toothpicks
- cocktail sauce

Prepare cocktail sauce ahead of time (even the day before) and chill thoroughly.

Simmer shrimp in salted or seasoned water until pink and tender, about 3 to 5 minutes. Drain and peel. Devein if desired. Chill thoroughly.

Separate, wash and dry endive.

Starting at the base of the cone and working up, cover the cone with overlapping leaves of endive. Fasten endive to the cone with toothpick halves. Cover fully with greens to resemble a Christmas tree. Use toothpicks to attach shrimp to the tree in loose spiral.

For flair, add a red bow to the top of your tree. Provide cocktail sauce for dipping shrimp.

The tree can be assembled several hours in advance. But be sure it is tightly wrapped in plastic to keep the shrimp from drying out. Refrigerate until ready to serve. Serves 15 to 20.

Cocktail Sauce:

- 1 1/2 cups catsup
- 1 tablespoon fresh lemon juice
- 1 tablespoon Worcestershire sauce
- 2 1/2 tablespoons prepared horseradish (more to taste)
- 1/4 teaspoon Tabasco sauce (more to taste)
- 1/8 tsp. freshly ground black pepper

In small bowl, combine catsup, lemon juice, Worcestershire, horseradish, Tabasco and pepper. Chill thoroughly. Refrigerate until ready to use.

TANGY CRAB DIP

- 1 pound backfin crab meat
- 8 ounces cream cheese, softened
- 1/2 cup sour cream
- 1/2 cup mayonnaise
- 1 tablespoon fresh lemon juice
- 1/2 teaspoon Tabasco sauce
- 4 tablespoons minced green onion, including tops
- 1/2 teaspoon pressed garlic
- 2 teaspoons horseradish

Remove any shell or cartilage from crab meat. Combine cream cheese, sour cream and mayonnaise in medium bowl. Add lemon juice, Tabasco, onion, garlic and horseradish. Gently fold in crab meat. Chill thoroughly. Serve with chips or assorted crackers. Makes about 2 1/2 cups.

CRAB-STUFFED MUSHROOMS

- 1/2 pound backfin crab meat
- 1 1/2 pounds large fresh mushrooms
- 1/2 cup light cream
- 1 tablespoon margarine or butter
- 1/2 cup fresh cracker crumbs
- 1 teaspoon dry mustard
- 1 tablespoon minced onion
- 1 tablespoon finely chopped fresh parsley
- 1/4 teaspoon salt
- 1/2 teaspoon prepared horseradish
- 1/4 teaspoon freshly ground black pepper
- 2 tablespoons margarine or butter, melted

Remove any shell or cartilage from crab meat. Remove stems and clean mushrooms with damp paper towel.

Combine cream and 1 tablespoon margarine in small saucepan. Cook over low heat until margarine melts, stirring frequently. Remove from heat. Stir in crumbs, mustard, onion, parsley, salt, horseradish and pepper. Gently stir in crab meat.

Spoon mixture into mushroom caps. Place in lightly greased baking dish. Brush tops with melted margarine. Bake at 350° F for 18 to 20 minutes or until thoroughly heated. Serves about 18.

Note: You can substitute chopped, cooked shrimp for the crab meat.

BAKED OYSTERS WITH BACON

- 2 dozen large, unshucked oysters
- 6 slices bacon
- 1 cup fresh cracker crumbs
- 1/2 cup mayonnaise
- 2 tablespoons thinly sliced green onion, including tops
- 1 teaspoon fresh lemon juice
- 1 teaspoon Tabasco sauce
- 1/2 teaspoon Dijon mustard
- 1/2 cup freshly grated Parmesan cheese
- rock salt

Scrub oysters with stiff brush under cold, running water. Shuck, reserving deep half of shells. Drain oysters.

Cut bacon slices into quarters. Cook until limp, but not brown.

In small bowl, combine crumbs, mayonnaise, onion, lemon juice, Tabasco and mustard.

Place deep layer of rock salt in bottom of large pan or baking dish. Arrange reserved shells in rock salt, being sure that they are level. Place one oyster in each shell. Spread crumb mixture over each. Top with a piece of bacon, then sprinkle with cheese. Bake at 450° F until bacon is crisp and oysters are done, about 8 to 10 minutes. Serves 4 to 6.

FLAKED FISH SALAD

- 2 cups cooked flaked fish
- 1/2 cup mayonnaise
- 1/2 cup finely chopped celery
- 1/4 cup finely chopped onion
- 2 tablespoons finely chopped pimento
- 1 tablespoon fresh lemon juice
- 1/2 teaspoon salt
- 1/4 teaspoon freshly ground white pepper
- lettuce

Place mayonnaise in medium bowl. Add celery, onion, pimento, lemon juice, salt and pepper. Mix thoroughly. Gently blend in flaked fish.

Chill well, overnight if possible. Serve on bed of greenery or on toast triangles. Garnish with tomato wedges. Serves 4 to 6. ▣

Learn more about Joyce Taylor and her volunteer Nutrition Leaders on page 6. To order a copy of Mariner's Menu: 30 Years of Fresh Seafood Ideas, *send your request and a check for $25 to North Carolina Sea Grant, NCSU Box 8605, Raleigh, NC 27695-8605. For Sea Grant office locations, call 919/515-2454. Also, this fall, check for the title at your local bookstore, thanks to distribution through UNC Press,* www.uncpress.unc.edu.

The Horseshoe Crab: Coastal Tank? Or Gentle Life-Bearer?

By Lilly Loughner
Photos courtesy of Delaware Sea Grant

A million-year-old "living fossil," residing mysteriously beneath the ocean depths, guided to land by the high tides of the new and full moons, hiding away its pearly green legacy, returning to the watery abyss of its prehistoric origins, the horseshoe crab is something spectacular, a bewildering species on an evolutionary scale, a wonder to people from all walks of life.

Even when contained inside of a touch tank at an aquarium, the horseshoe crab seems altogether menacing — with its helmet-shaped shell and long, arrow-like tail. Its legs seem "creepy-crawlish" as they wriggle from beneath an armored body that appears to have pinchers, stingers or devices for attacking prey.

"I love all the claws and stingers and spikes on them," says youngster Jarod Williams on a visit to the N.C. Aquarium at Pine Knoll Shores. While Williams is fascinated by the horseshoe crab's appearance, many approach the tank with first-time inhibitions.

The touch tank curator is swamped with questions such as "Do they sting?" and "Do they bite?"

Once questions are answered and fears negated, the frightening creature of the ocean deep is transformed into a valuable, hands-on learning experience.

According to the curator, David Travis, most people express amazement and will explore and touch the horseshoe crabs. Some even will pick them up. Only a small percentage of visitors allow fear to overtake curiosity — choosing not to interact with the horseshoe crabs.

But there should be no cause for alarm. Horseshoe crabs are not really crabs, as the common name suggests. In truth, the horseshoe crab, genus *Limulus*, is more closely related to the arachnids — spiders and scorpions — than any species of crab.

Continued

Again, despite the deadly reputation of the arachnids, the horseshoe crab is indeed a gentle creature. Unless you are a mollusk — mollusks are this so-called crab's main food source — horseshoe crabs can be quite inspiring. Experiencing their benign nature may cause one to yearn for an equally calming and harmless nautical existence.

THE 'LIVING FOSSIL'

The lineage of the horseshoe crab is one of the most amazing aspects of the animal. The genus *Limulus* originated in the Triassic period, which is the first period in the age of the dinosaurs. And its ancestors — trilobites — were dominant Earth creatures 100 million years before dinosaurs even existed.

Not only has the horseshoe crab evaded extinction over millions of years of evolution, but the genus *Limulus* has evolved very little throughout history.

"Horseshoe crabs are ecological generalists: they can withstand a wide range of conditions, natural as well as man-induced." And their "...jack-of-all-trades nature...holds the clue to why they have remained so stable, so evolutionarily unchangeable for hundreds of millions of years," writes Niles Eldredge in his book *Fossils*.

LIFE CYCLES OF THE BROWN AND SCARY

You'd be lucky to come across live horseshoe crabs on the beach outside of their spring spawning season. They are benthic creatures, preferring a lifestyle adapted to offshore habitats near the continental shelf, as well as shallow estuarine areas.

The horseshoe crab is generally nocturnal. When active, it may swim upside down or burrow and crawl along the sandy ocean floor in search of invertebrate prey. Upon finding its meal, the horseshoe crab grinds the sea worm or whatnot with the base of its legs, and then pushes the ground food into its mouth with, again, its all-purpose legs. If, by chance, the crab becomes overturned, it can use its telson, or tail-like appendage, as a tool for flipping back to a more comfortable position.

Of the four remaining species of the ancient horseshoe crabs, three inhabit waters along the coasts of India, Japan and Indonesia.

Limulus polyphemus, the fourth and most abundant species, exists along the Atlantic coast of North America. Its range extends from northern Maine to the Yucatan Peninsula, with the largest population of *Limulus* occurring along the Delaware Bay.

The Delaware Bay is home to the largest population of horseshoe crabs in the world, regardless of species. And is a main breeding site, where thousands of horseshoe crabs travel to shore at high tide during a new and full moon.

The smaller males attach to the females' carapace and hitchhike onto shore with flooding tides. Once a couple reach their destination, the female digs a nest, in which she can produce up to 88,000 eggs. Several males may crowd to fertilize the nest in the process.

Since it takes female horseshoe crabs about 10 years to reach sexual maturity — males average eight years — the amount of eggs is not excessive. This is especially true if the eggs become exposed to the sandy shore surface and therefore vulnerable to a variety of predators, such as small fish, juveniles of larger fish and shorebirds.

In the Delaware Bay area alone, close to a million migratory shorebirds have coevolved with horseshoe crabs. "Horseshoe crabs are critical to the welfare of migrating shorebirds that stop along the Delaware Bay each spring to fuel up prior to the flight north to Arctic nesting grounds. Some of these birds double and even triple their weight by feasting on horseshoe crab eggs," says Bill Hall, marine education specialist for the University of Delaware's Sea Grant Marine Advisory Service.

If an egg actually survives long enough to hatch and grow to adulthood, the horseshoe crab may live out a lengthy lifespan of 20 or more years.

ABOVE: Nancy Targett, a University of Delaware marine biologist, says local watermen are dependent upon harvesting horseshoe crabs as bait for lucrative fisheries. RIGHT: One female can produce up to 88,000 eggs for several males to fertilize. The eggs are vulnerable since they are 'fast food' for shorebirds that stop to fuel up during their migratory journeys.

HUMANITY'S LUCKY HORSESHOE

Humans also have acquired a dependence on this enduring organism, although one of a more economic nature.

Modern commercial harvest of horseshoe crabs as bait supports a $2 million conch fishery and a $6 million American eel fishery.

"In Delaware Bay alone, watermen derive 20 to 50 percent of their total fishing income from conch or eel harvests," write University of Delaware marine biologist Nancy Targett and former graduate student Kirstin Ferrari.

The horseshoe crab also is a valuable resource to biomedical companies because its blood contains a clotting agent, *Limulus* ameobocyte lysate (LAL), which reacts to bacteria. LAL can be produced by extracting the blood from live horseshoe crabs, and is used to detect microbial pathogens in human blood, injectable drugs, intravenous fluids and other medical devices and supplies. The extraction procedure generally does not harm the horseshoe crabs.

HORSESHOE CRABS IN PERIL?

They have survived through millions of years of global change, predation and even an asteroid blast. So why are so many horseshoe crab monitoring programs sprouting along the Atlantic?

"Since horseshoe crabs are used for the production of LAL, there has been more interest in their abundance," explains Whitney Kurz, coastal training program coordinator for the N. C. National Estuarine Research Reserve, who organizes a census in North Carolina.

Also, the Atlantic States Marine Fisheries Commission (ASMFC) has enacted the Interstate Fishery Management Plan for the Horseshoe Crab. Fifteen Atlantic states, including North Carolina, must abide by the plan, which aims to "determine horseshoe crab population densities and spawning locations," says Kurz.

One volunteer-driven census of breeding horseshoe crabs, conducted in the Delaware Bay area since 1990, was recently modified to meet ASMFC standards.

Delaware Sea Grant organized the first census, and now, every spring, volunteers continue their count on nine key beaches in Delaware and nine in New Jersey. The recent census was designed through the cooperation of the U.S. Geologic Survey, U.S. Fish and Wildlife Service, several universities and state management agencies and a biomedical company.

Hall, who helps organize the annual Delaware census, describes the spawning population structure of the horseshoe crabs as having "bottomed out" because it has remained relatively stable over the past three years. He compares this trend to the initial decline beginning in the early 1990s, which "noted a significant downturn in the animal's population, from 1.2 million spawning females down to about 250,000."

There are many theories as to the causes of the decline, such as loss of spawning habitat and global change. But, overfishing is believed to be the primary cause of the rapid decrease in horseshoe crab spawning populations. And, since commercial fishing is a factor that is within immediate human control, research continues to analyze the negative effects of horseshoe crab harvesting.

For instance, current research may convert the economic and ecological problem of the harvesting of horseshoe crabs into a win/win situation.

Targett is working on a Sea Grant-funded project to create artificial bait by zeroing in on the compound that attracts eels and conch to prey on horseshoe crabs. One of Targett's main objectives is to "take some of the pressure off of the horseshoe crab population."

The bait is created by using an attractant derived from the horseshoe crabs eggs, and is currently undergoing preliminary field trials. Targett hopes to eventually "develop a source of the attractant that is independent of the horseshoe crab." ◘

TOUCH AND ADMIRE/ LEARN AND APPRECIATE

Volunteer for horseshoe crab surveys in North Carolina by contacting Whitney Kurz at 252/728-2170 or whitney_kurz@ncnerr.org.

Delaware Sea Grant is developing a regional horseshoe crab website. Look for it later this year at www.ocean.udel.edu/seagrant.

For more information also check "The Bridge," Sea Grant's marine education site, at www.vims.edu/bridge.

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FROM THE EDITOR

Storm Stories

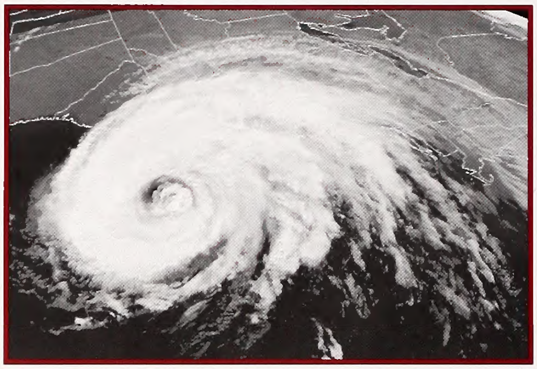

Photo courtesy of NOAA

The eye of Hurricane Isabel hit shore on the Outer Banks, just south of Cape Hatteras.

For many, the enduring image of Isabel's visit is the new inlet on Hatteras Island. But, what of other impacts of the storm?

Floodwaters swamped communities profiled in past issues of *Coastwatch* — Cedar Island in Carteret County, Swan Quarter in Hyde County and Edenton in Chowan County. Damage extended to countless towns in Virginia and Maryland.

As clean-up and rebuilding continues, Sea Grant researchers are evaluating a wide variety of impacts from Isabel.

Xian Lie and Len Pietrafesa, both of North Carolina State University, were gathering new data before the storm. A new model for predicting coastal storm flooding was funded initially as a Sea Grant/National Severe Storms Lab partnership and now is a major NOAA project.

Their model is still in development stages, but it provided preliminary storm surge forecasts to the National Weather Service days ahead of the storm — rather than hours ahead with existing models.

As the storm was headed our way, so, too, were wind researchers from South Carolina, Texas and Florida who work with Spencer Rogers, North Carolina Sea Grant's coastal construction specialist. Temporary towers along the coast from Wilmington to Elizabeth City documented a full wind field for the storm, including readings on Hatteras Island.

Soon after the storm passed, the Federal Emergency Management Agency asked Rogers to join a team to evaluate oceanfront damage from Kitty Hawk to Hatteras Village. The survey showed flooding and wave damage to newer homes that did not follow traditional designs of only allowing parking within the piling foundations. The team will review flood map accuracy and compare damage to codes when the structures were built.

Immediately after Hurricane Isabel, western Pamlico Sound showed a well-mixed water column, but low salinity levels, reports Larry Crowder, a Sea Grant researcher at Duke University's Marine Lab, who collaborates with Joe Ramus of Duke and Hans Paerl of the University of North Carolina at Chapel Hill.

When the researchers crossed Bluff Shoal into the eastern sections of the sound, closer to Hatteras and Ocracoke islands, the water column became stratified, which could lead to oxygen depletion problems. Sea Grant is funding additional studies there.

Meanwhile, Jeff Buckel of NC State found the lower Chowan River had low-oxygen areas as well as some with no dissolved oxygen — and few or no fish. In the Albemarle Sound, oxygen and species counts were higher.

These are just a few of the science lessons from Isabel that we expect to update in 2004. But, there are also lessons in human resilience — ones that are especially poignant during the holiday season.

On page 20, read about celebrations in Columbia and at Somerset Place that will take place despite weeks of cleanup after the storm.

And in the last issue of *Coastwatch*, you met Lissie McNamee, a Nutrition Leader who tested recipes for Sea Grant's *Mariner's Menu* seafood book. Her Carteret County home was flooded, but her mood was upbeat at a book reception after the storm.

"The view is still as beautiful as it ever was," she said with a smile.

Katie Mosher, Managing Editor

IN THIS ISSUE

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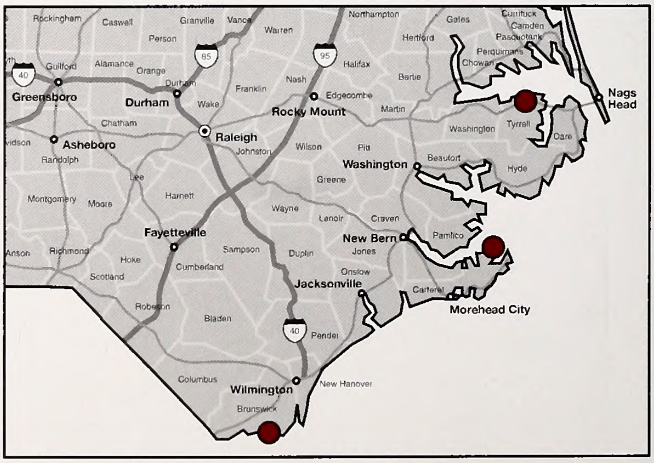
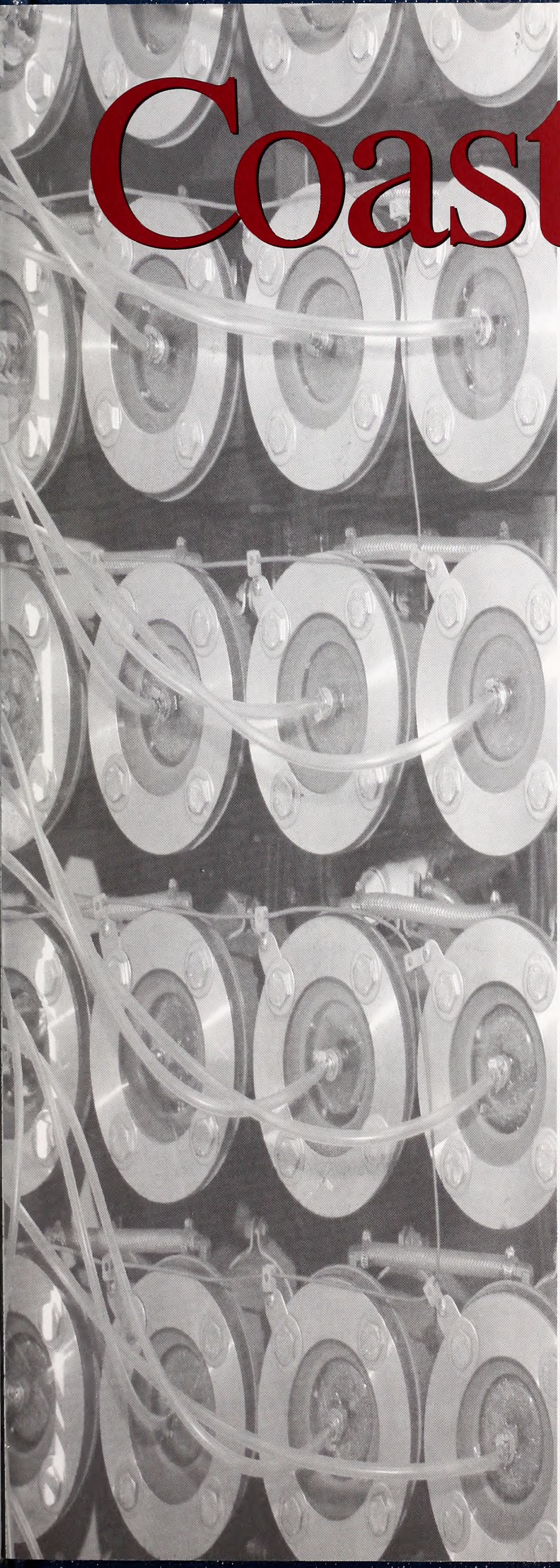
North Carolina's diverse coast offers countless interesting subjects. The large dots on the locator map indicate story settings in this issue — including Tyrrell, Brunswick and Carteret counties.



Coastwatch



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Coastwatch

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The North Carolina Sea Grant College Program is a federal/state program that promotes stewardship of our coastal and marine resources through research, extension and education. It joined the National Sea Grant College Network in 1970 as an institutional program. Six years later, it was designated a Sea Grant College. Today, North Carolina Sea Grant supports research projects, a 15-member extension program and a communications staff. Ron Hodson is director. The program is funded by the U.S. Department of Commerce's National Oceanic and Atmospheric Administration and the state through the University of North Carolina.

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Front cover photo on board the Tonsina *and table of contents photo of ozone generator system by Karen Orders.*

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COASTAL
TIDINGS

Knauss Fellows Head for Nation's Capital

Four North Carolina scholars are heading for the nation's capital as Dean John A. Knauss Marine Policy Fellows for 2004. They will spend the coming year learning about federal policy-making processes that affect the ocean, coastal and Great Lakes resources:

Roger Winstead

FRONT: Jessica Maher, Adrienne Harris
BACK: Bo Dame, Shauna Slingsby

James "Bo" Dame earned a doctorate in coastal resource management at East Carolina University.

Dame, selected as a legislative fellow, earned a bachelor's degree in geological sciences at Lehigh University in 1984, and a master's in marine science at the Virginia Institute of Marine Science, College of William and Mary in 1990.

Dame's doctoral work focused on utilizing food web modeling as a holistic approach to evaluating ecosystems. It has potential applications for many coastal issues, including managing marine protected areas, evaluating habitat restoration, and in multi-species fisheries management.

Jessica Maher earned a master's degree in environmental management at Duke University. Maher, selected as a legislative fellow, earned a bachelor's degree in biology, with minors in chemistry and environmental studies, at the University of North Carolina at Wilmington.

At Duke, her master's project focused on Atlantic bottlenose dolphins in restricted areas of the Pamlico Sound. This work was funded by the Marine Corps Air Station at Cherry Point in order to determine the potential adverse effect on dolphins in the bombing ranges or adjacent areas.

Adrienne Harris earned a master's degree in environmental management at Duke. Harris, selected as an executive fellow, earned a bachelor's degree in natural resources and environmental science, with an emphasis in biology and water quality, at Purdue University.

At Duke, her master's project addressed global-scale environmental issues, especially in developing an international convention for the control of ballast water. Her interests include water quality and invasive species, as well as international marine policy.

Shauna Slingsby earned her master's degree in marine science at UNC-W. Slingsby, selected as an executive fellow, earned a bachelor's degree in conservation and resource management at the University of California at Berkeley.

At UNC-W, her master's studies focused on the ecology of coral reef ecosystems, especially the health of juvenile corals, and human impacts. Her field work took her to Florida, Mexico and Bonaire (Netherland Antilles). In Bonaire, she also was part of a Marine Park Service team helping to establish a Fishing Protected Zone within the coral reefs.

The fellowship, valued at $38,000, is sponsored by the National Sea Grant College Program. — P.S.

In the Next Issue of *Coastwatch*

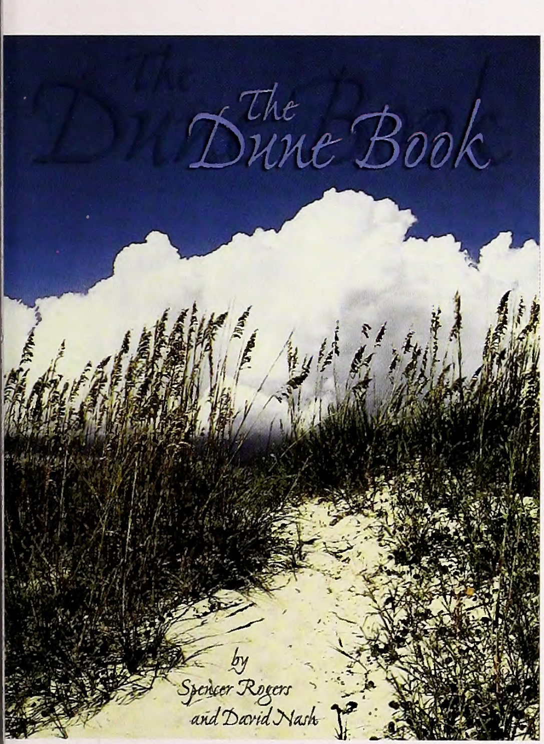
Sea Grant researchers retrace the path of Hurricane Isabel to assess her impact on North Carolina's people, places and coastal waters. Ann Green discovers nightlife in the Alligator River Wildlife Refuge. And Pam Smith introduces readers to the newest members of the Sea Grant team.

Attend Annual Waterfowl Weekend

Want to see Harkers Island waterfowl carvings? How about model boats and copper sculptures? A variety of artisans will exhibit their work at the Core Sound Waterfowl Weekend, Dec. 4-7, at the Core Sound Waterfowl Museum on Harkers Island. The Down East celebration also will feature storytelling, net hanging, traditional music and local historians. Visitors also will learn about duck blind building and hike on trails near the museum.

The public events officially kick off with an outdoor decorating contest on Friday, Dec. 5. On Sunday, visitors can participate in a morning community fellowship. For more information, call 252/728-1500 or visit the Web: *www.coresound.com.* – A.G.

New Book Highlights Dunes



Want to find out about the best dune grasses for the North Carolina coast? How about dune planting and fertilizing tips?

This information and other dune guidelines are featured in *The Dune Book* by North Carolina Sea Grant coastal construction and erosion specialist Spencer Rogers and N.C. Cooperative Extension agent David Nash. The colorful and comprehensive guide highlights the best dune management practices along developed shorelines, as well as common development practices and regulations in North Carolina. Detailed color illustrations and photos help explain dune practices and plant species.

In addition, the authors provide in-depth information about erosion types – from storm-induced erosion and post-storm recovery to long-term erosion and inlet erosion.

To order *The Dune Book*, call 919/515-2454 or write: North Carolina Sea Grant, NC State University, Box 8605, Raleigh, NC 27695-8605 and ask for UNC-SG-03-03. Single copies are $5. Visit the Web: *www.ncseagrant.org* and click on products. – A.G.

Fisheries Conference Set for D.C.

Registration is open for the first fisheries management conference, "Managing Our Nation's Marine Fisheries: Past, Present and Future," Nov. 13–15, at the Omni-Shoreham Hotel, Washington, D.C.

The conference, free and open to the public, is designed to educate the public, policy makers and the media on the fishery management process. Successful management practices and research initiatives will be highlighted. Poster sessions and panel discussions are planned.

Information presented will be timely as Congress considers reauthorization of the Magnuson-Stevens Fishery Conservation and Management Act, which governs national marine fisheries decisions.

For a complete view of the agenda and registration information, go online to *www.managingfisheries.org*. – L.L.

Americans Ate More Seafood in 2002

In 2002, Americans ate a record amount of shrimp. It also was a record year for overall seafood consumption.

Consumption of shrimp (all types of preparation) achieved a record 3.7 pounds per person, according to the National Oceanic and Atmospheric Administration's National Marine Fisheries Service. Researchers also found that seafood consumption in the United States was up 7.1 percent, with Americans consuming 4.5 billion pounds of domestic and imported seafood in 2002.

The 2002 per capita consumption level of 15.6 pounds of total seafood per person represents an increase of almost one pound from the 2001 level. Of the 15.6 pounds of seafood consumed per person, a record 11.0 pounds were fresh or frozen fish or shellfish, 4.3 pounds were canned seafood, and 0.3 pound of seafood was cured.

Compared to 2001 figures, this represents a 0.7 pound increase in the fresh/frozen products and 0.1 pound in the canned products.

For more information about 2002 seafood consumption, visit the Web: *www. nmfs.noaa.gov,* and click on announcements.

– A.G.

Grant Programs Accepting Proposals

The Fishery Resource Grant (FRG) and Blue Crab Research programs are searching for research ideas from those who fish for a living or work in fishery-related industries. The programs recognize that good ideas for protecting or improving the state's fishery resources often come from those who work in the fisheries.

The deadline for submitting proposals for 2004 is fast approaching – Nov. 17, 2003.

Both programs are funded by the General Assembly and administered by North Carolina Sea Grant.

FRG requires applicants to be involved in fishery-related businesses or have substantial involvement with, and endorsement from, such industries. Involvement in the crab fishery is strongly encouraged for applicants to the Blue Crab Research Program.

Grant recipients often are paired with academic researchers to ensure useful, well-documented results.

For more information about FRG, contact Sea Grant specialists: Bob Hines, 252/222-6312 or Skip Kemp, 252/222-6314, both in Morehead City; Jim Bahen or Scott Baker in Wilmington, 910/962-2492; Sara Mirabilio in Manteo, 252/475-3663; or Barry Nash at the NC State University Seafood Lab, 252/222-6337.

For information about the Blue Crab Research Program, contact Sea Grant specialists Marc Turano, 910/520-7060, or Bob Hines, listed above.

Or call North Carolina Sea Grant's Raleigh office at 919/515-2454 for information about either program. Application forms and other information are available online at *www.ncseagrant.org*.

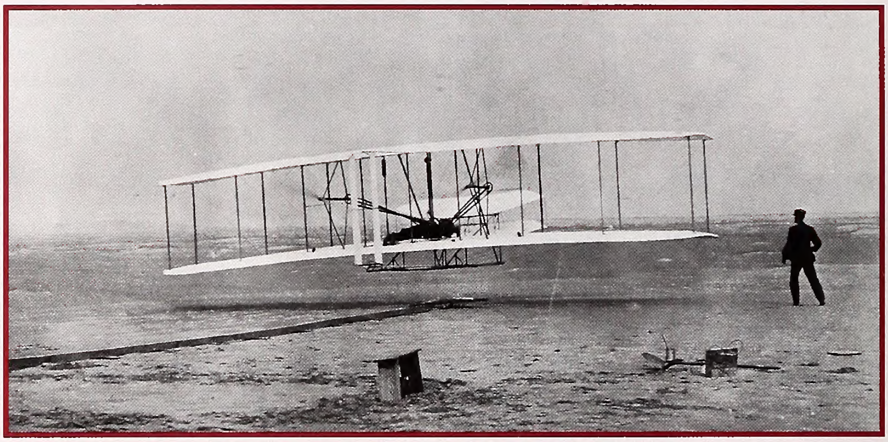
– C.H.

Holiday Gifts from Sea Grant

Let North Carolina Sea Grant help with holiday gift-giving ideas:

- For cooks on your list, consider *Mariner's Menu: 30 Years of Fresh Seafood Ideas*; $25. Catch the book's author, Joyce Taylor, at the Core Sound Waterfowl Museum Festival, Dec. 6 or 7.
- A subscription to *Coastwatch* is a gift that keeps giving for a full year; $15.

Send requests and checks to North Carolina Sea Grant, NCSU, Box 8605, Raleigh, NC 27695-8605; or call 919/515-9101.



Courtesy of N.C. Archives and History

The Wright Brothers chose the Outer Banks to test their flying machine in 1903.

Celebrate First Flight

In 12 seconds, the Wright Brothers made history 100 years ago with their first flight at Kitty Hawk.

To commemorate the first sustained flight, the First Flight Centennial Celebration will be held Dec. 12-17 at the Wright Brothers National Memorial in Kill Devil Hills.

The celebration will feature aircraft demonstrations, a 100-person jump team, a display of military aircraft and a special ceremony honoring 100 aviation heroes. In addition, the Wright Experience team will re-enact the first flight with an authentic reproduction of the 1903 flyer.

Tickets are required for most events. For ticket information, visit the Web: *www.firstflightcentennial.org*, or call 800/973-7327.

– A.G.

Students are Partners in Flight

School kids across North Carolina and Ohio will have an opportunity to be part of the First Flight celebration on Dec. 17, thanks to the Partners in Flight and the Internet.

Partners in Flight, sponsored by the N.C. Department of Public Instruction, links pre-K through 12th grade classes to learn about their historical connection to the Wright Brothers.

The semester-long project culminates with the live, interactive Webcast commemorating the birth of powered flight a century ago.

Webcast participants will experience science- and art-based inquiry into the ways flight has changed the world. Activities include "panel discussions" inspired by interactive conversations with astronauts on board the International Space Station.

To be part of the Dec. 17 Webcast, contact Cris Crissman at *ccrissma@dpi.state.nc.us*. For information about Partners in Flight, go online to *www.ncpublicschools.org/distancelearning/eforums*.

– P.S.

Marine Mammals Conference Set

Experts who study marine mammals — manatees, dolphins, whales and porpoises — are heading inland for the XV Biennial Conference on the Biology of Marine Mammals, Dec. 14-19, at the Joseph S. Koury Convention Center/Sheraton Greensboro Hotel. Hosted by the Society for Marine Mammalogy, the conference will provide the opportunity for professional marine mammal biologists and students to share the latest studies and knowledge.

Nearly 1,500 scientists from more than 30 countries are expected to attend the conference. Workshops will present varied topics, from Ethics in Marine Mammal Research to the Biology of the Genus Koiga — sperm whales.

A Dec. 17 evening event will be open to the public to provide information on the effects of sound on marine mammals.

For further information, go to *http://smm2003biennial.marinemammalogy.org* or contact Edward O. Keith at 954/262-8322 or at *conference@marinemammalogy.org*. — L.L.

Commercial Fishing Show Celebrates Heritage

The North Carolina Fisheries Association will host the 24th annual North Carolina Commercial Fishing Show Feb. 28-29 at New Bern's Riverfront Convention Center.

Visit North Carolina Sea Grant's education display in the main exhibit hall to learn about our latest research, education and extension activities.

The annual event is an opportunity to celebrate the state's commercial fishing heritage. Members of the fishing industry see the latest marine technologies — from engines to foul weather gear. The general public gets a glimpse of what it takes to get the fish from the boat to the dinner table. Special activities for youngsters include a scavenger hunt and arts and crafts.

The agenda also includes seminars that highlight successful Fishery Resource Grant and Blue Crab Research projects, which are funded by the N.C. General Assembly and administered by Sea Grant. The projects are meant to enhance the commercial fishers' efforts and profits.

For the complete two-day agenda, as well as sponsorship opportunities, go online to *www.ncfish.org*. — P.S.

Check Out *Troubled Waters* from UNC-W

The University of North Carolina at Wilmington's latest documentary, *Troubled Waters: The Illusion of Abundance,* takes a compelling look at the world's water dilemma.

Narrated by UNC-W Chancellor Emeritus James R. Leutze, the documentary originally aired on UNC-TV, and now is available on video at schools and libraries across the state. The hour-long program explores the global, national and statewide water supply crisis — and potential solutions.

The state's drought of the summer of 2002 may have faded from memory with the wet spring and summer of 2003, but water supply issues remain a top public policy concern in North Carolina.

The documentary project includes an educational Web site, *www.uncw.edu/troubledwaters,* complete with lessons and activities for educators and students. The site also suggests related books, articles and Web sites; international, national and state agencies; conservation tips; and examples of water-wise entities.

The documentary, produced by UNCW-TV, is available for purchase at $22.95. To order, or to request additional information, contact Barbie Cowan at 910/962-2650. — P.S.

Pam Smith

Morehead Train Depot Preserves Past

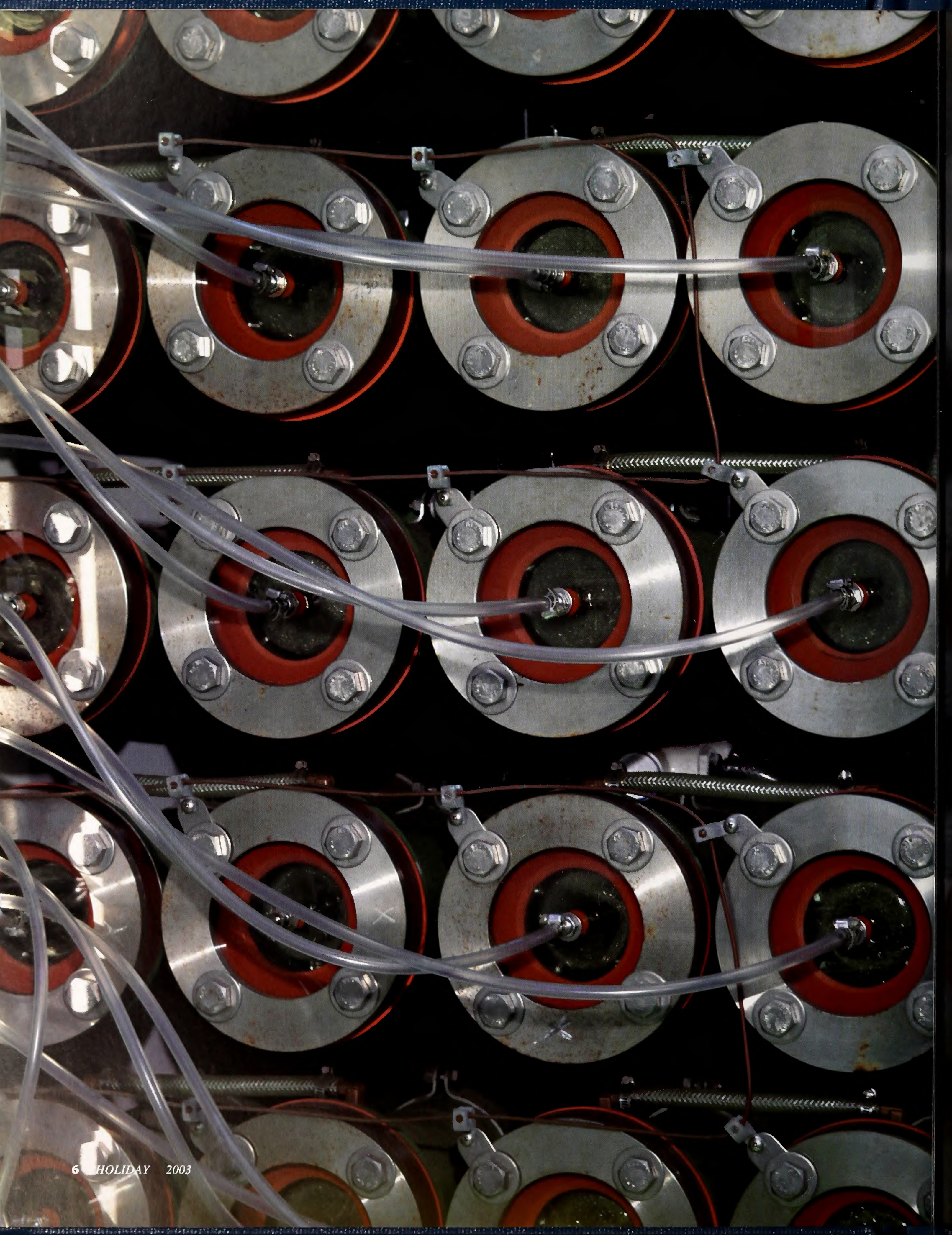
A 1905 train depot — once a bustling place around which Morehead City grew and prospered — will not be forgotten. Instead, community leaders plan to relocate and preserve the station.

The building soon will travel down Arendell Street to City Park. There, renovations will transform the depot into a historic community building containing a public meeting facility.

The history of the rail service is integral to Morehead's past. In the early 1850s, Shepard Point Land Company bought 600 acres of what is now Morehead City with the intent of constructing a Beaufort Inlet port. With the help of Gov. John Motley Morehead, rail service was established in 1858, connecting Goldsboro to the port.

The railroad quickly became the heart of the town. And it wasn't long before the creation of the Atlantic Hotel stimulated travel to Morehead, nicknaming it "Summer Capital by the Sea."

Now the 1905 depot is of no use to the North Carolina Railroad, which donated the structure to the town. The U.S. Department of Agriculture Rural Development office has provided funding for this Downtown Morehead City Revitalization Association project. — L.L.



BALLAST WATER BATTLES:

NORTH CAROLINA AND WASHINGTON SEA GRANT PROGRAMS JOIN FORCES TO CURB UNWANTED INTRODUCTIONS OF BALLAST WATER ORGANISMS

By David G. Gordon

And Melissa Lee Phillips

Photos by Karen Orders

AT LEFT: Close-up of the Tonsina's *ozone generator system. Electricity discharged into each canister transforms oxygen into ozone that kills ballast water organisms.*

IMAGINE THIS...

Bathed in early morning light, the Caspian Prince, *a 900-foot freighter leaves Antwerp, Belgium, bound for the Port of Wilmington, N.C., to fill its cargo hold with tobacco. For this leg of its journey, the ship is empty... or so it seems.*

Within the Caspian Prince's *hold and ballast tanks are millions of gallons of seawater, drawn from the northern European harbor to lend stability and trim to the vessel during its two-week ocean crossing.*

The ballast water contains a mini-menagerie of aquatic organisms — minute jellyfish, larval mussels and barnacles, marine worms, tiny shrimp-like copepods and juvenile fish. These creatures share their confines with an assortment of single-celled plants and even smaller bacteria and viruses. Many of these organisms can withstand the hardships of a journey across the Atlantic Ocean.

When the ship docks in Wilmington and empties its ballast tanks before loading its cargo, the plants, animals and microbes are unintentionally released into the Cape Fear River. Freed from their confines, the ballast water organisms may multiply and thrive.

This scenario may be imaginary — but the concern is real.

It is likely how the zebra mussel, a fingernail-sized mollusk from the Black, Caspian and Azov seas entered the Great Lakes in the late 1980s. Since their introduction, zebra mussels have spread rapidly to all of the Great Lakes and to waterways in many states, as well as the Canadian provinces of Ontario and Quebec. Growing in dense clumps, the mussels can encrust and foul facilities at power plants, fish ladders and industrial sites. To date, natural resource managers have been powerless to stop the mussels' spread.

"Thousands of species of marine life are currently being transported in ballast water," says William Cooper, a Sea Grant researcher at the University of North Carolina at Wilmington. "It's unclear what long-term effects such large-scale introductions will have, but the evidence to date suggests there could be serious trouble ahead," he adds.

LITTLE CRITTERS, LARGE WOES

Releases of ships' ballast water have been blamed for the spread of the bacteria known to cause cholera. In the Chesapeake Bay, for example, researchers have identified a new strain of *Vibrio cholerae*, the organism that causes cholera, with origins in the Mediterranean or North seas. Health officials in Delaware, Maryland and Virginia must remain vigilant to prevent outbreaks of the disease caused by this particular strain.

Introductions of exotic plankton species can shift the balance of aquatic ecosystems. First sighted in Cape May County, N.J., in 1988, the non-indigenous Asian shore crab (*Hemigrapsus sanguineus*) has rapidly expanded its range. This small (1.5-inch) but highly adaptable crustacean now occupies coastal niches from Maine to North Carolina. Researchers anticipate that the crab will continue to proliferate, edging out native species that share its habitats.

The problem of unwanted ballast water organisms is hardly limited to the East Coast. In San Francisco Bay, for example, more than 230 non-native aquatic shore-dwelling species already have taken over in mudflats, shoals and along the coast.

Continued

LEFT TO RIGHT, TOP TO BOTTOM: The deck of the Tonsina *— note ballast tanks along the sides and bottom of the tanker. Ballast water-sampling equipment at the ready. Filling a sample bottle with water pumped from one of the* Tonsina*'s 12 ballast tanks. Fine-meshed zooplankton nets capture ballast water organisms. Zooplankton samples are concentrated in the plankton net and placed in a plastic container.*

On the lower Columbia River, a natural boundary between the states of Oregon and Washington, at least 61 of the 292 known plant and animal species are non-native. Some, such as the Asian clam *(Corbicula flumine,* so thoroughly dominate the sediment in some stretches of the Columbia that little else can survive. If that's not bad enough, these introduced pests can proliferate to such a degree that, like zebra mussels, they will eventually clog irrigation ditches and fish screens.

With funding from a National Sea Grant initiative and other sources, Cooper and his West Coast counterpart, Russ Herwig, with the Washington Sea Grant Program in Seattle, are looking at ways to curb future introductions of ballast water organisms along the nation's coasts.

For the past three years, Cooper has been working with a team of scientists to develop the technology to treat ballast water before it is dumped. For nearly two years, Herwig's crew has been testing the new equipment in the field, working aboard the oil tanker *S/T Tonsina.* It is one of a fleet of tankers that carries oil — and ballast water — from the Port of Valdez in Southeast Alaska, to Long Beach, Calif., Puget Sound, Wash., and other destinations along the Pacific Ocean coast.

This collaborative project began several years ago, when the *Tonsina*'s principal owner, British Petroleum, recruited Nutech O3, Inc. of MacLean, Va., to develop and design a shipboard ballast water treatment system, using ozone as the active ingredient. Nutech recruited Cooper to oversee the ozone chemistry at play.

In turn, Cooper contacted Herwig and his colleagues at the University of Washington, asking them to conduct field tests of the system. Cooper and Herwig saw the national and international importance of applied research on ballast water — and the *Tonsina* would provide a demonstration opportunity to evaluate how the ozone theories would translate to real shipboard experiences.

HARMLESS, HI-TECH FIX

Ozone gas is produced when an electrical impulse is shot through air that is rich in oxygen.

"When you smell the air after a lightning storm, you're smelling ozone," Cooper explains. Ozone has been used for decades to disinfect drinking water, swimming pools and aquariums. It is incredibly effective at killing bacteria and viruses in water. Because it degrades quickly, reverting back to oxygen, it is safe for these freshwater applications.

Today, the *Tonsina* is equipped with almost seven kilometers of stainless steel tubing through which ozone gas is conveyed to the ship's ballast water. The process is relatively simple, and there is no need to bring potentially harmful chemicals on board ship. "All you need is electricity and air," Cooper notes.

A stream of oxygen-rich air is sent through an electrode, exposing the gas to 10,000 volts of electricity. The ozone gas that emerges is then sent to the 15 ballast tanks on board through a system of 1,200 diffusers, which Cooper compares to aerators in fish tanks. The gas bubbles through the ballast water continuously while the ship is in transit. Ozone oxidizes the tissues of any ballast water organisms inside, destroying them.

According to Cooper, the ideal ballast water treatment system would kill organisms of all sizes, a requirement that many potential technologies have failed to meet. "We're looking at every trophic level in the water system, from viruses and bacteria all the way up to fish," the UNC-W chemist says.

While ozone kills microorganisms like bacteria and viruses almost immediately, larger organisms often escape treatment. However, when ozone reacts with bromide naturally present in seawater, bromine is formed. Bromine extends the effects of ozone treatment because it also can disinfect — and bromine does not degrade as rapidly as ozone.

This combination of ozone and bromine has the potential to eliminate entire populations of microbes and planktonic organisms within the ballast water tanks. Initial tests, conducted in Long Beach, Calif., and Port Angeles, Wash., have shown that the ozone treatments can kill up to 99.99 percent of the bacteria and phytoplankton in ballast water.

The system was somewhat less effective at destroying zooplankton, but the success rate was still above 90 percent.

TESTING THE WATERS

As one group of scientists monitors the effectiveness of the *Tonsina's* ozone treatment technology, another gathers samples of ballast water organisms. This means gaining access to each ballast tank through a service hatch, or manway — an access secured with many bolts, some rusted in place since last time the ship was serviced. "The ship's crew has been extremely cooperative and very interested in watching our sampling efforts," Herwig says.

Once the crusty hatches are cracked open, the team collects plankton samples, pulling a small plankton net, or "tow," through the tank. One tow will amass about 5,000 planktonic organisms in its stocking-shaped sieve. Microbe-laden water samples also were collected in five-liter Niskin bottles for subsequent lab analysis.

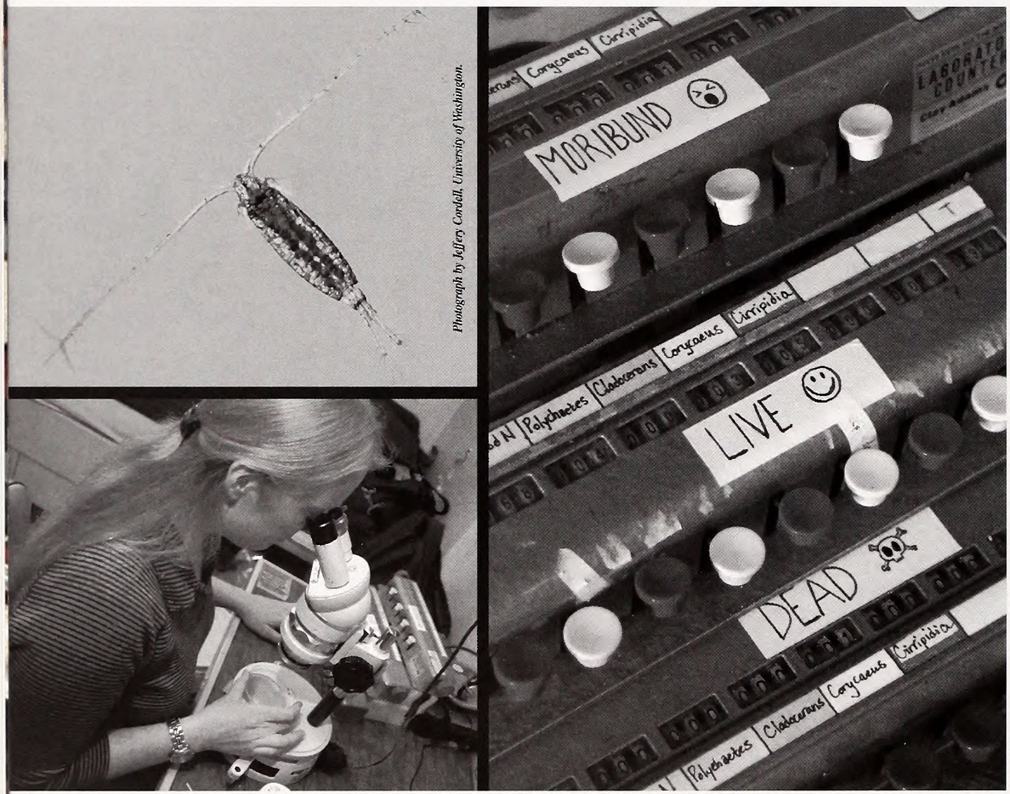
"Collecting samples is the fun part,"

Continued

LEFT TO RIGHT, TOP TO BOTTOM: Russ Herwig holds a zooplankton sample bottle, with student Kim MacDonald in the background. Samples are "fixed" with preservative so they can be examined by scientists in other labs. Scientist handles one of the smaller tubes of treated ballast water. An open hatch leads to ballast tanks. Banks of ozone generator tubes. Connected to a microscope, this monitor offers enlarged views of the critters.

Herwig says with a wry grin. "After that comes many hours spent processing samples and sorting those tiny planktonic organisms by genus and species."

While sorting the plankton, the researchers seek to distinguish foreign species from those native to North America's West Coast waters. They also try to recognize species associated with coastal and open ocean habitats.


Photograph by Jeffery Cordell, University of Washington.

TOP: Sinocalanus doerri*, an Asian planktonic copepod — first appeared in San Francisco Bay in 1978 and in the Columbia River estuary in 2002 — and is thought to have been introduced into these environments by ballast water. BOTTOM: Tallying samples to determine how the ozone system is working. RIGHT: A keypad identifies which forms of zooplankton are "live," "dead" or "moribund."*

That latter distinction is especially valuable in gauging the effectiveness of what scientists call mid-oceanic exchange — an international voluntary ballast water management measure.

To reduce the possibility of introducing exotic aquatic organisms, the Washington State Legislature recently approved a bill requiring transoceanic vessels to empty and refill their ballast tanks in the open ocean. Vessels entering U.S. ports are required to report these activities to the U.S. Coast Guard.

Legislatures in California, Hawaii, Maryland, Oregon and Virginia have enacted similar laws. Though not legislated in North Carolina, Erik Stromberg, North Carolina Ports Authority executive director, spearheaded efforts in 1998 to ensure that vessels en route to state ports engage in ballast water exchange before entering the U.S. Exclusive Economic Zone.

Ballast water exchange on the high seas greatly reduces the chances of ships ferrying planktonic aquatic organisms from one nearshore area to another.

Alas, seawater swapping is probably not sufficient to eliminate the threats from ballast water releases. The designs of most ballast tanks make it difficult to drain every drop of water or replace all of the living organisms in a ballast tank, says Herwig. Sediments also may accumulate in the nooks and crannies of a ballast tank. Living organisms and resting stages of organisms may accumulate in the sediments.

Furthermore, Washington's ballast water regulation has a loophole. A ship's crew can be exempted from making mid-ocean exchanges if stormy seas or other conditions would present insurmountable safety hazards.

FINE-TUNING AND TEAM-BUILDING

Ozone treatment may sound great in principle, but there's still work to be done. That's because the extended life of bromine can raise environmental concern. Ozone's quick decay rate means it is unlikely to threaten native life when the ballast water is poured out.

Longer-lived bromine, however, still may be present in the released water, so scientists must make sure that bromine will not harm the aquatic systems into which it is released. For this reason, researchers are trying to pin down the lowest concentration of ozone that will get the job done.

Lower concentrations of ozone also will reduce operational costs — an important consideration in getting the shipping industry to adopt this technology. The *Tonsina*'s formidable network of stainless steel pipes almost certainly would be too expensive for most ships to install, so the experimenters also are exploring a less costly alternative system.

Instead of bubbling ozone gas through a maze of tubes for the entire voyage, the new streamlined set-up simply will inject ozone into the seawater on its way to the ship's ballast tanks.

Herwig suspects that employing a combination of ballast water treatment technologies — ozone, ultra-violet light, chemical additives and fine-meshed filters — ultimately may be the best way to tackle the invasive species problem. Perhaps different technologies will be appropriate for different types of vessels, he suggests. There also may be sequential treatments developed.

Many researchers, says Herwig, believe that a filtration step could be used first to remove larger organisms and then a second step, perhaps ozone treatment, would follow to remove the smaller life. For now, though, there is no consensus about which methods are most likely to pay off.

One thing is certain, however: industry approval is key. "Wherever our research takes us, it's essential that we work closely with the shipping industry," Herwig notes. "There's no point in coming up with measures that are too impractical to be implemented. What shipping company would be eager to adopt a technology that took up three-fourths of a cargo hold? Understanding and solving the problems associated with ballast water also requires a multidisciplinary approach, teams of scientists, engineers and representatives from the shipping and regulatory communities."

Cooper agrees with Herwig's assessment. "The industrial component of this is very large and very cooperative," he says. "This particular project is an example of multi-institution academic and private industry cooperation and collaboration, which has led to some astounding results that we would not have been able to obtain if this cooperation wasn't in place."

Collaborators on this project currently include Gregory Ruiz from the Smithsonian Environmental Research Center, Robert Gensemer from Parametrix, Inc., Paul Dinnel from Western Washington University, and Jeffery Cordell from the University of Washington.

Industry partners come from BP Oil Shipping Company, the Alaska Tanker Company, Nutech O_3, Inc., and Northeast Technical Services Company, Inc. of Olmstead Falls, Ohio.

Each Thursday, a conference call connects scientists and executives from all of the participating institutions. "No one is left out," Cooper says. "Everybody has an equal say. We all decide where we're going and how we're going to get there most efficiently, and then we charge off."

Cooper also emphasizes that, though cost is of course a consideration, the group holds its work to high scientific standards.

"The most important thing is that we do research that's scientifically defensible. That's been the philosophy of our collective group ever since we started," he says.

"We're doing it because we want to get answers to solve real problems." ◘

David G. Gordon is a science writer with Washington Sea Grant, where Melissa Lee Phillips is a communications intern.

BALLAST WATER
MANAGEMENT INFORMATION

In 1990, Congress directed the U.S. Coast Guard, then under the Department of Transportation, to establish a mandatory national ballast water management program for vessels entering the Great Lakes.

Russ Herwig and Bill Cooper

Photo by Robyn Ricks, Washington Sea Grant

Then, in 1996, Congress directed the Coast Guard to establish a national ballast water management program that included a voluntary mid-ocean exchange initiative for transoceanic vessels — with mandatory reporting. However, compliance is sketchy at best.

When the Coast Guard was transferred to the Department of Homeland Security in 2003, ballast water management became a priority.

At the urging of both the Coast Guard and the American Association of Ports Authorities, the department published a "Notice of Proposed Rulemaking" in the National Register: "The Coast Guard proposes mandatory ballast water management practices for all vessels equipped with ballast tanks bound for ports or places within the U.S. and/or entering U.S. Waters. The Great Lakes (mandatory) ballast water management program would remain unchanged. The proposed rulemaking would increase the Coast Guard's ability to protect U.S. waters against the introduction of NIS (nonindigenous species) via ballast water discharges."

Currently the Department of Homeland Security is reviewing comments and is expected to develop the final rule in 2004.

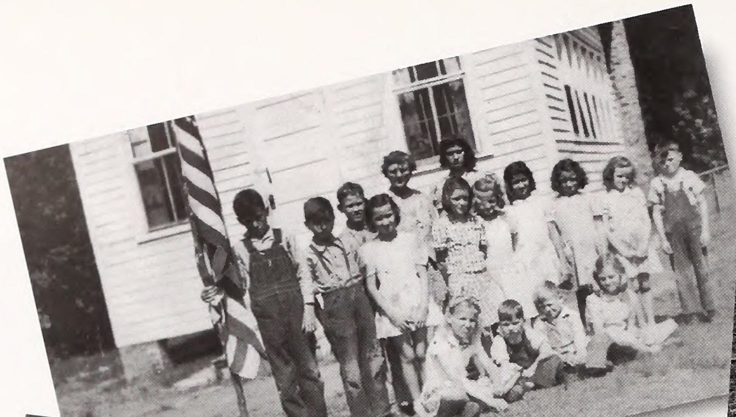
Along with mid-ocean ballast water exchange and reporting, the rules would approve alternative "environmentally sound" methods of ballast water management as they are developed and tested for effectiveness.

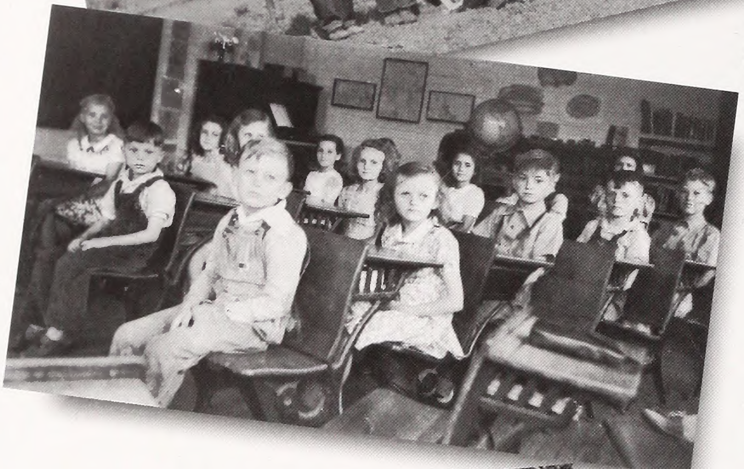
In addition, the International Maritime Organization currently is negotiating a binding international agreement for mandatory ballast water management by member nations. Adoption is expected in 2004, with ratification and implementation by 2006.

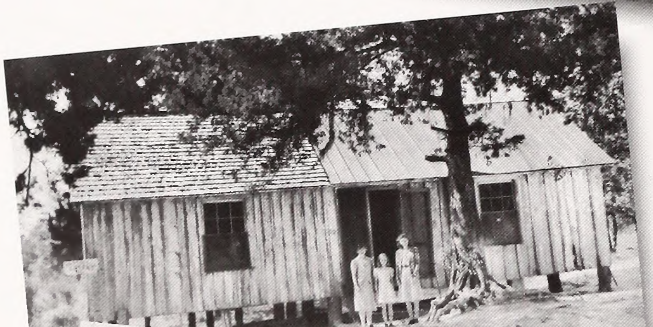
For a complete overview of the ballast water issue, here are a few resources:

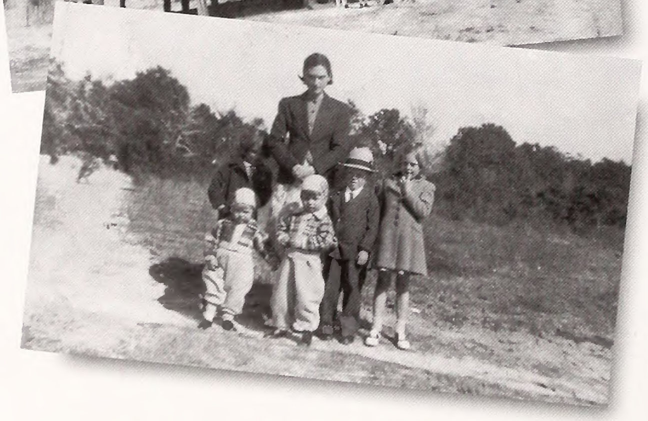
- American Association of Ports Authorities: www.aapa-port.org
  Click on "Government Relations".
- Science News article, with a discussion of ANS and the **Tonsina** project: www.phschool.com/science/science_news/articles/stemming_the_tide.htm
- Alaska Journal of Commerce article on the **Tonsina** and ozone: www.alaskajournal.com/stories/042902/loc_tiny_hitchhikers.shtml
- Alaska Sea Grant radio story on the **Tonsina**: www.uaf.edu/seagrant/NewsMedia/02ASJ/11.22.02ballast-invaders.html
- West Coast Ballast Project: http://Ballast-outreach-ucsgep.ucdavis.edu
- Washington Sea Grant: www.wsg.washington.edu/
- Northeast Midwest Institute: www.nemw.org/biopollute.htm#laws
  For an overview of the National Aquatic Invasive Species Act (NAISA) and the National Invasive Species Act (NISA).
- National Sea Grant research initiatives: www.nsgo.seagrant.org/research/nonindigenous/index.html

Vintage photos from the 1940s courtesy Sara Jane Norman Hardy.









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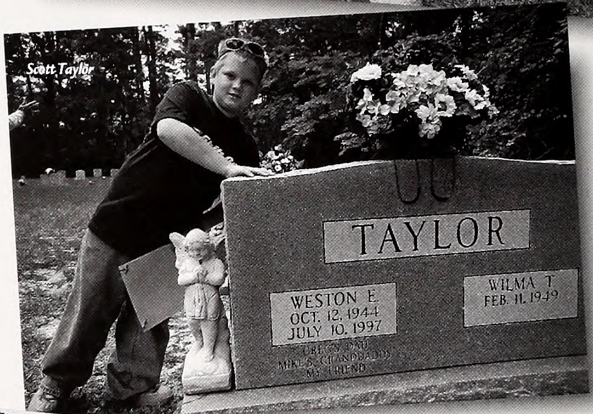
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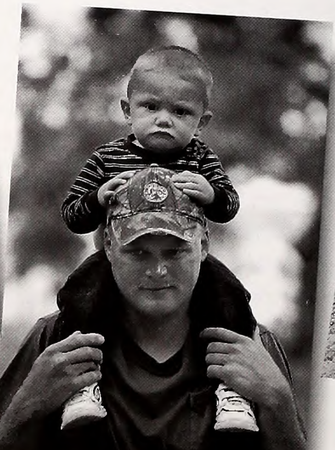
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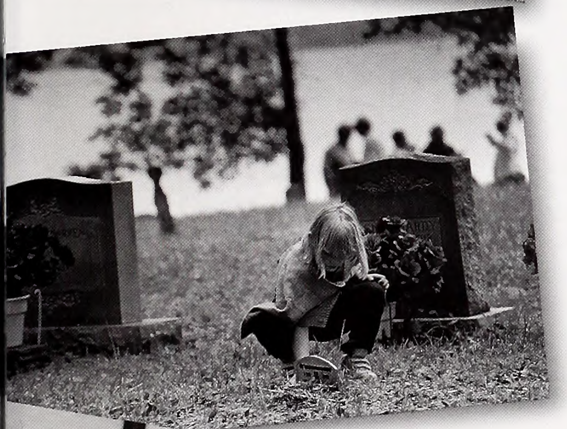
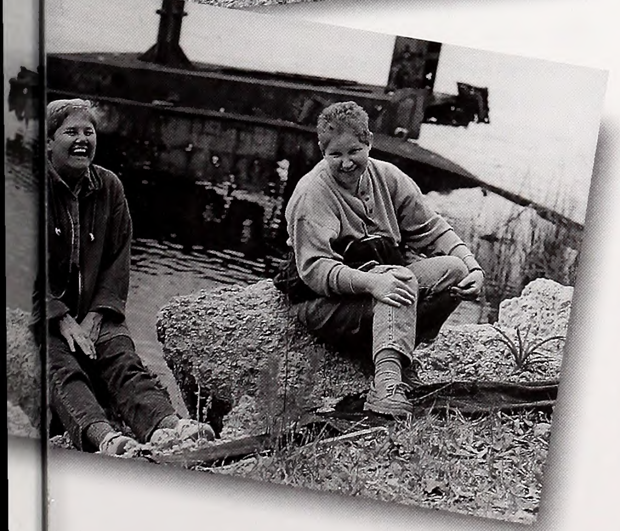
LEFT TO RIGHT, TOP TO BOTTOM: One-room school, 1940s. • Twins Guion Hardy and Gwen Hardy Rose. • In remembrance of Mama. • Lukens' classroom, 1944–45. • Michael Taylor at his grandfather's headstone. • Quiet contemplation. • Teacher Grace Wilson with Sara Jane Norman and her mother, Nellie, by the general store and post office, 1940s. • Crossing the South River, reunion-goers journey into the past . • Lovingly tended graves. • Nellie Norman with Elsie, Gary, Brantley, Bruce and Sara Jane, 1940s. • Lukens last 4th grade class — Janice Norman, Kathleen Hardy, Sara Jane Norman and Vonda Norman. • Jamey Norman Jr. and Jamey Norman Sr. • A happy reunion gathering.





Looking Back at Lukens

By Julie Powers

Lukens isn't on the maps. No signs point the way. Someone looking for the little town along the South River can't find it by car. Nor by boat. Nor even on foot.

The only way to visit the village now is through the people who once lived there.

Like other early coastal communities now absent from the sandy landscape, memories and gravestones are all that's left of Lukens. Settled in the 1700s on a Carteret County peninsula, it once was sizable for its time and place. More than 120 people fished, farmed and logged for a living in Lukens, on the eastern shore of the South River, as late as the 1940s.

But world and local events turned against it. By 1948, nobody lived in Lukens anymore. Its homes and gathering places — the church, the store, the school — were moved across the water, or fell to ruin on the lonely riverbank.

Lukens is luckier than most forsaken towns. Former residents and families gather at the South River fire hall every May to remember it, and many then ride a barge to where Lukens used to be.

For some, the mile-long passage is a return to younger days and simpler times — to when they learned their lessons in the one-room school, the mail came by boat, and the gardens, the groves, the woods and the river provided almost everything they needed.

"Something draws you back," says Sara Jane Norman Hardy, whose family left Lukens for Oriental in 1945, when she was 11. "I feel like it's a very special place."

For months after the move, she says, she'd stand by the Neuse River and look toward where Lukens had been. "I'd want to go back there so badly," she says.

Other former residents also tell of a love for Lukens that has lasted more than 50 years. But it wasn't enough to save it from succumbing to a series of setbacks and trends of the times.

A Quick End

Some say a frightful 1933 hurricane that destroyed half of its 26 homes foreran Lukens' demise, just as such storms doomed Diamond City on Shackleford Banks. Global events also conspired to lessen Lukens. Electricity and highways on the mainland were changing lifestyles. And World War II had called away the town's young men at a critical time — the loss of Lukens' longtime leader.

Daily life had depended heavily on the busy Henry Tillman Banks. He ran the store and the post office. He was a magistrate, the poll keeper and the clerk at the Free Will Baptist Church. On the county board of education, he saw to hiring the schoolteacher.

"When he died, there was just nobody, really, to take over and do the things that he did," recalls Hardy, his granddaughter.

Lukens did not expire slowly, contrary to its ghost town counterparts such as Portsmouth on Cape Lookout National Seashore. A few stubborn citizens persisted at Portsmouth until 1971, and some of its buildings still stand. But just four years after Banks died in March of 1944, Lukens had vanished.

When the store closed, mail service ended. School convened with 18 pupils that fall, but no teacher came the next term. Hardy had four siblings.

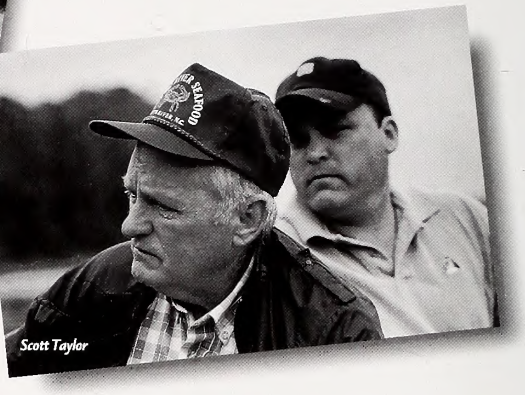
"My mother just said we had to go to school," she recalls. Families departed en masse for South River, Oriental and other nearby towns. The schoolhouse was moved to South River. Lumber from the church went to build a South River house. By 1948, everybody and almost everything in Lukens had been borne away by boats and barges. The few structures left eventually decayed or burned.

Two smaller communities on the peninsula — Brown's Creek and Turnagain Bay — had disappeared decades before Lukens did. Details

Continued

Scott Taylor

Scott Taylor


Scott Taylor

LEFT TO RIGHT: Tom Tosto, who captains the reunion barge, tells a tale about Lukens to visitors. A visitor arranges flowers for a departed loved one. Gary Norman, foreground, looks back at Lukens and his childhood as the barge departs for South River.

differ, but countless other far-flung hamlets perished when they couldn't cope with change.

"The coast of North Carolina is littered with dozens, probably hundreds, of communities like Lukens," says David Cecelski, a coastal North Carolina native who teaches history at Duke University. "What seems exceptional to me about Lukens is that its descendents still care about it and try to honor it and look after it."

Water Ways

The annual Lukens gathering had its beginnings in grief. The barge that transports the reunion parties also carries caskets and mourners to Lukens' main cemetery, now owned by the county. Lukens has always been, for all practical purposes, beyond the reach of roads.

"We were going over there at the funerals," explains barge captain Tom Tosto of South River, whose wife, Bertha, grew up in Lukens and was buried there in 1997. "That wasn't the time to visit and get reacquainted."

Thus, about 15 years ago, the happier assemblies began.

The pretty graveyard, also known as Buzzard Bay Cemetery and the largest of seven on the peninsula, remains the barge's destination. The land that once was Lukens now belongs to a hunting club and is off-limits. Nothing of the town can be seen anyway. The mantle of oaks and pines has covered all traces of the neat homes once scattered along the bank; the fences, footpaths, flowerbeds and boats are gone.

The cemetery itself, sloping high above the river, is an essay in quiet contemplation of days past. An enormous live oak shades headstones dating to the mid-1800s. Ballast stones from early trading ships mark graves of unknown age for unknown souls.

Though settled two centuries before, the town didn't get its name until 1913, when it acquired a post office. William Lukens was a Pennsylvanian who built a sawmill and established a post office named after him on the west side of the South River. After the mill closed, the post office — and its name — moved across the river, where it soon claimed a corner of Banks' general store.

Lukens would be considered remote today, but not in its heyday, when water was the main mode of transportation. What roads existed often were impassable.

"If you went anywhere, you took the sharpie and went to New Bern," recalls Tosto, who grew up in South River. But land travel had improved by the 1940s, along with other advancements. Good jobs and an easier life elsewhere beckoned, perhaps hastening Lukens' dissolution.

"By then the automobile and the prosperity had become available," Tosto says.

So today, to borrow an epitaph from one of its tombstones, Lukens is gone but not forgotten.

Going Home Again

Gary Norman, now of New Bern, was six when he and his sister, Sara Jane, and the rest of his family joined the exodus.

"I remember walking this shoreline catching soft crabs," Norman says, as the barge casts off from the cemetery dock. With no refrigeration or supermarkets, he recalls, the food supply was a constant concern. Everybody kept livestock, tended gardens, fruit trees and vines, and worked the water. Norman recalls a community spirit that might explain why town ties have remained so strong for so long. The men joined forces to hunt deer, he says. "They'd cut that venison up and everybody got a share, regardless of who killed it."

Neighbors visited each other, helped each other and trusted each other, Norman recalls. "There never were any doors locked."

Lukens was not complete paradise, of course. "In the summertime, the mosquitoes were so bad, they'd take kerosene and paint the screens with them," he says, and the foul odor would permeate the houses.

Lukens had its share of hardships and heartbreaks. It took hours to get a doctor. Life often was cut short, as the many infant graves testify. Men and women had to labor long to raise families while contending with hurricanes, hot summers, bitter winters, rattlesnakes and water moccasins.

Still, Lukens is where many choose to spend eternity.

Gwen Hardy Rose and her twin brother, Guion Hardy, of Harkers Island, brought flowers to the cemetery, where their father was buried in 1954; their mother, in 1993.

Gladys Hardy had told the twins, now 56, many happy stories of life in Lukens. She had left Lukens before they were born, but her heart was always on the east side of the river. Now, she lies under the spreading branches of the big live oak.

"She always said if there wasn't but a little piece of her left, she wanted to be put over here," says Rose. "She loved Lukens." ■

Coastal Ghost Towns:
'Everywhere we go down there, we're walking on graves.'

Calamities — hurricanes, war, disease — were the ruin of some communities that have vanished from North Carolina's coast. Changing times, altered circumstances and simple economics, however, doomed many more.

"I can think of several dozen right offhand — fishing villages that died when the fish got used up, river towns that died when dredging opened up more inland ports, or when the railroads came, or the highways; timber boomtowns that died off when the forest got cut down. To say nothing of all the Indian villages that are gone," says David Cecelski, who grew up on the coast and teaches history at Duke University. "Everywhere we go down there, we're walking on graves as far as I'm concerned."

Most deserted places are long forgotten but a few live on in legend.

Cape Lookout National Seashore in Carteret County is the setting for two storied ghost towns — Portsmouth Village and Diamond City. Founded in 1753 near Ocracoke Inlet on North Core Banks, Portsmouth was a busy port until an 1846 hurricane opened new inlets — and new shipping routes. Then, when Northern troops approached in the Civil War, many residents fled, never to return.

Ferocious storms, the closing of a U.S. Lifesaving Service Station and modern mobility slowly emptied the island village, accessible only by boat. Its last residents left in 1971. Its pretty church, tiny post office and several quaint yellow houses still stand, maintained as a historic exhibit by the National Park Service.

Diamond City on Shackleford Banks was scared to death by a hurricane. A whaling and fishing outpost in the 1800s, Diamond City's 500 residents made it the largest of several communities on the island.

In August of 1899, a fearsome storm scoured away houses, gardens and livestock, and flattened sheltering dunes and trees. Fearing future tropical tempests on the bared sands, islanders departed Shackleford, taking their houses with them.

Scott Taylor

A soundside graveyard is all that remains.

On the Dare County peninsula, supply and demand — involving lumber, then liquor — accounted for the rise and fall of Buffalo City, once Dare's biggest settlement. The now quiet shores of Mill Tail Creek off the Alligator River hosted a boisterous sawmill boomtown, named for Buffalo City Mills, the New York lumber company that built and operated it, from the 1880s until the 1920s.

After loggers had taken the choicest timber and left, moonshine kept the remote enclave in business until Prohibition's repeal in 1933 ended the market for bootleg booze. People gradually moved away, and sweet gum and cypress cloaked the remains of the sawmill.

The forest also has taken back nearby Beechland, except for a wisp of mystery. A plague of "black tongue," presumably cholera, is said to have wiped out most of the population in the mid-1800s.

Beechland's beginning is not so well defined. And that, for some, poses an intriguing question about North Carolina's foremost missing town — the Lost Colony that disappeared in the 1580s from Roanoke Island.

An enduring Dare County legend says the Roanoke colonists, fearing a Spanish attack, fled a few miles inland to a sandy, beech-covered ridge in the swamp, and established their new home at Beechland. ▣

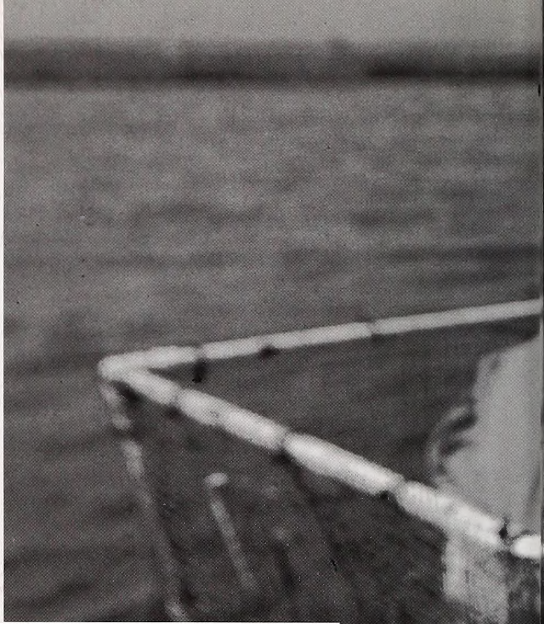
For More Information

BOOKS:

- *A Historian's Coast* by David Cecelski, published 2001, John F. Blair.
- *The Outer Banks of North Carolina* by David Stick, first published 1958, University of North Carolina Press.
- *The Five Lost Colonies of Dare* by Mary Wood Long, published 2001, Family Research Society of Northeastern North Carolina.
- *South River: A Local History from Turnagain Bay to Adams Creek* by Dollie C. Carraway, published 1994, M&L Designs.

OTHER SOURCES:

- The History Place, Carteret County Historical Society, 1008 Arendell, Morehead City, NC 28557; phone 252/247-7533; *www.genelines.net/phpBB2/.*
- Outer Banks History Center, Route 400, Ice Plant Island, P.O. Box 250, Manteo, NC 27954; phone 252/473-2655; *www.ah.dcr.state.nc.us/sections/archives/arch/obhc/.*
- Cape Lookout National Seashore, 131 Charles St., Harkers Island, NC 28531; phone 252/728-2250; *www.nps.gov/calo.*
- Core Sound Waterfowl Museum, 1785 Island Road, Harkers Island, NC 28531; phone 252/728-1500; *www.coresound.com.*



KICKING UP FACTS FOR HARD CLAM MANAGEMENT

By Cynthia Henderson • Photos by Scott Taylor

ABOVE: Eileen Vandenburgh and research technician Jeff Smith carry equipment into the shallow area of Middle Marsh during a predation experiment with clams and stone crabs. RIGHT: Vandeburgh holds an M. mercenaria that's been attacked by a stone crab, while Smith checks an experimental cage.

Yankee ingenuity's got nothing on Carolina clam fishers — although it could have something to do with the research partnering of, in Eileen Vandenburgh's words, "a girl from New Jersey and a fisherman from Cedar Island."

Vandenburgh, who grew up on the Jersey Shore and is now a doctoral student in ecology at the University of North Carolina at Chapel Hill and the Rachel Carson National Estuarine Research Reserve System (NERRS), has been working with fisher Dallas Goodwin to study the effects of mechanical clam harvesting. Goodwin practices clam kicking — an efficient fishing technology homegrown in Core Sound that is extensively practiced, according to Vandenburgh, only in North Carolina.

Clam kicking is so efficient, in fact, that the N.C. Division of Marine Fisheries (DMF) has made new regulatory changes for the practice — changes that Vandenburgh recognized as a unique research opportunity.

The DMF has closed an area of northern Core Sound to kicking for two years as part of an ongoing rotation plan. During the time that Core Sound is closed to kicking, an area never-before kicked, in southern Pamlico Sound, will be open. The idea is to allow the overharvested northern Core Sound to recover while the new area is being kicked. Vandenburgh proposed sampling in spring and fall 2001 in the Pamlico area before kicking began so that effects of the fishing technology can be assessed.

She found support for the research from the North Carolina Fishery Resource Grant Program (FRG). Partnerships such as Goodwin and Vandenburgh's have become the hallmark of FRG, which is funded by the General Assembly and administered by North Carolina Sea Grant to combine fishing expertise with academic research to improve and protect the state's fishery resources.

HOMEGROWN TECHNOLOGY

According to an article by James Guthrie and Curtis Lewis of the National Marine Fisheries Service in Beaufort, a form of clam kicking started in the 1940s when sails were being replaced by small motors in North Carolina fisheries.

Fishers noticed clams were exposed — or kicked — by wash from propellers that passed over them. Soon, innovative clammers were devising methods to make use of the phenomenon for harvesting clams. One method, believed to have started at Harkers Island, according to Guthrie and Lewis, was to anchor a boat and pass it in an arc in shallow waters where clams lay buried in sandy bottoms.

Bob Austin has fished commercially for more than 25 years and can remember when clamming was a "subsistence fishery."

But the fishery for hard clams — whose scientific name, *Mercenaria mercenaria*, is reputed to have come from the clam shell's use as money by native Americans — was to change dramatically as the kicking method was perfected.

Around 1980, Austin says, "People got real good at it." Boats were made with deeper keels and with specialized flood bins to lower boats into the water for more efficient kicking, he explains.

"Efficiency was dramatically improved with the innovation of topless nets, replacing nylon netting with steel rings and replacing the net tail bag with a steel cage," he adds.

Nets pulled behind kicking boats harvest clams kicked up by propeller wash.

"Clam kicking was a boon for this area about 20 years ago," says Austin. "A lot of homes were built here in eastern Carteret County with clam money."

DMF statistics support his observation. Statewide, harvests in pounds of hard clams more than doubled between 1976 and 1977 — from about 306,000 to almost 740,000 pounds. By 1980, harvests had risen to over 1.5 million pounds. The dollar value increased from about $258,000 in 1976 to more than $5.5 million in 1980.

And Austin suggests that the numbers may actually have been higher because the more accurate trip-ticket method of recording harvests was not started until about 10 years ago.

But the success of clam kicking was not without a down side. State harvests of hard clams began dropping in the early 1990s to just under 620,000 pounds in 2002, according to DMF figures.

"One problem is that it is so efficient that, if not carefully managed, it's easy to deplete the resource," says Austin, who has a degree in biology and has taught environmental science at the high school level. He also is on the board of directors for *Crossroads*, an environmental advocacy group in Carteret County.

Austin says he kicked clams until about five years ago when the area he was working in Core Sound became too depleted to be worthwhile.

"There are some who like to talk about natural cycles" to explain the decreased clam harvests, Austin explains. But he contends the "very efficient" method of clam kicking is the more likely explanation.

The new rotation plan for alternating clam kicking between northern

Continued

LEFT: Vandenburgh examines a crab pot for stone crabs that will be used in an experiment. BELOW: Vandenburgh digs up the experimental plot within the cage.

Core and southern Pamlico sounds is intended to allow areas that are kicked to recover. Austin says the rotation system has worked in the White Oak and New rivers, and he supports the plan for the Core and Pamlico areas.

It is the new rotation plan that gave Vandenburgh a unique research opportunity — to study bottom areas before and after being kicked.

THE STUDY

So far, Vandenburgh says, the clam fishery in Core Sound has not been sustainable, with harvests dropping and fewer boats participating. By special permit, Vandenburgh and Goodwin were able to sample areas that have been open as well as areas closed to clam kicking since 2001. They also sample an area of southern Pamlico Sound, where kicking is not done, in order to study the variations in clam populations over time.

Sampling of bottom areas is done both by a huge vacuum-cleaner-like device called a suction dredge, as well as from Goodwin's kick boat, which will give realistic data about the impact of the fishery.

Data currently are being analyzed for 2001 and 2002. Vandenburgh hopes that findings will help in managing the fishery to assure a sustainable resource.

She and Goodwin received new FRG funding in 2003 to continue the 2001-2002 study. The new project also will evaluate the potential of spawning stock sanctuaries to enhance clam recruitment and future yields.

Austin says part of the problem with clam populations is that the spawning stock was depleted. The technology of clam kicking allowed for harvesting in deeper water. "That's where the spawning stock was," he says.

Vandenburgh notes in her research proposal that, when fishing pressure increased in the mid 1970s, "virgin stocks of large chowder clams up to 48 years old were harvested in the creeks of Core Sound along Core Banks."

Spawning stock was depleted statewide as a result of that fishing pressure, according to Vandenburgh's proposal.

The current study will evaluate whether clams are recruited to public areas from a seven-acre lease where clams are grown to spawning size prior to harvesting.

And Vandenburgh will continue to study the effects of clam kicking on the virgin population and the recovery of the previously overharvested area.

For Vandenburgh, the collaboration underscores that "fishermen are tough people."

"We're out a really long time," she says. "It takes two hours to get to Pamlico, so we're out there easily 15 to 16 hours."

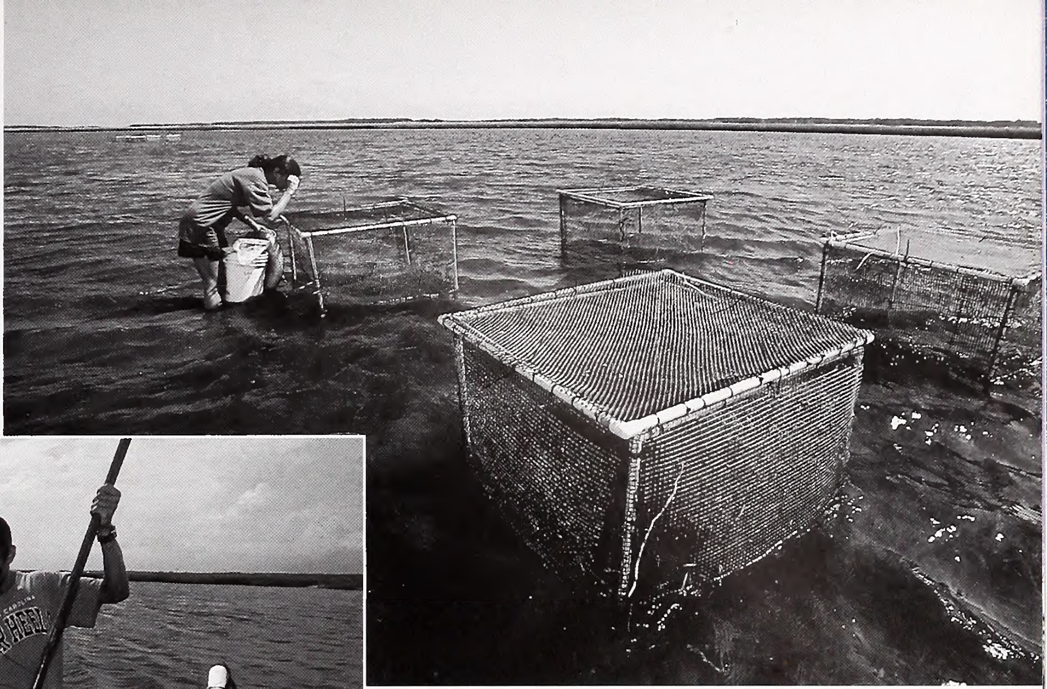
It will be worthwhile, as Vandenburgh believes the information gleaned from the study will "be helpful to North Carolina fishermen. I would like to have it used by DMF to manage the fishery and make it a reliable resource."

RESEARCHING THE HABITAT

Trish Murphey, shellfish biologist with the DMF, says that clam kicking began picking up in the mid-1970s when a bad winter up north caused "an increase in demand down here."

Prior to the 1970s, waters were open statewide, Murphey says. Then, in the late 1970s, restrictions were placed on amounts harvested and on fishing seasons. The successful clam-kicking rotation plan between the New and White Oak rivers started about 20 years ago.

The regulations not only were intended to prevent overharvesting hard clams, but also were intended to protect habitats. Seagrass beds, for instance



RIGHT: Vandenburgh peers into the cage to see if the stone crab escaped by digging a hole. BELOW: Smith retrieves the stone crab from the cage.

are restricted from all clam kicking.

In a 1987 study funded by Sea Grant, researchers Pete Peterson, Henry Summerson and Stephen Fegley at the UNC-Chapel Hill Institute of Marine Sciences showed that seagrass beds suffered long-term declines from clam kicking. Because seagrass beds are vital to a number of ecologically and economically valuable species, such losses can have serious consequences for many fisheries.

Effects of clam kicking on other bottoms are not understood. Vandenburgh explains that clam kicking in sand flats has not been shown to cause declines in bottom-dwelling invertebrates or in recruitment of hard clams. The FRG study allows sampling of bottom areas both before and after being kicked.

Austin says the effects on sandy bottoms may even be beneficial. "I don't think that, on clear open bottom, that kicking clams is harmful to the habitat."

In fact, he says, "Some old timers say the bottom gets stagnant and needs to be stirred up." He compares the effect to that of strong storms thought to be necessary to the health of the estuary.

Vandenburgh has drawn no conclusions about the study. The data have not been fully analyzed, she says.

But Murphey, who worked on the Hard Clam Fishery Management Plan, says Vandenburgh's work already has been useful to DMF. The abundance of data collected by Vandenburgh helped determine how long to keep areas closed in the rotation plan, Murphey says.

Austin says many fishermen are hoping to go back to clam kicking when northern Core Sound opens again this winter. He is hopeful that the new rotation plan will work. "I think most fishermen are behind it, because they see that most of Core Sound has been exhausted, and in the southern area of the state, a two-year rotation works well." ▣

EILEEN VANDENBURGH HONORED

Eileen Vandenburgh was one of four National Estuarine Research Reserve (NERR) fellows to receive the Walter B. Jones Award for 2003.

The award, authorized under the Coastal Zone Management Act of 1972, honors the late North Carolina Congressman Walter B. Jones, Sr., and recognizes "outstanding accomplishments in the field of coastal zone management" — accomplishments that help to balance human use of resources against ecosystem requirements.

U.S. Rep. Walter B. Jones, Jr. presented the Jones Award for Excellence in Coastal and Marine Graduate Study to Vandenburgh.

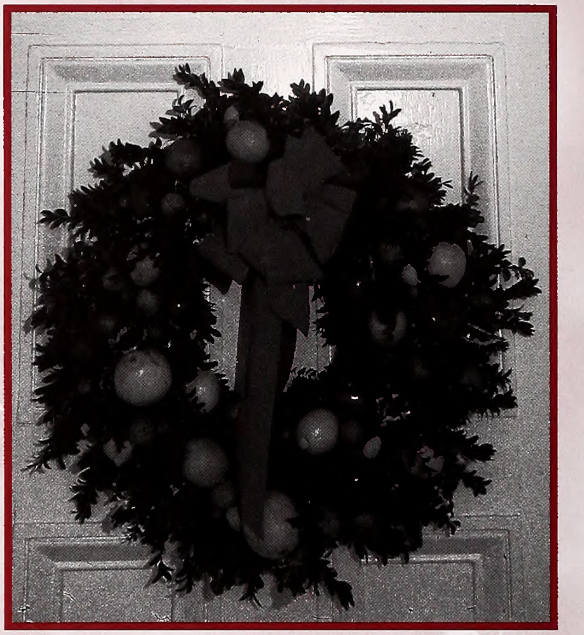
As a NERR fellow at the Rachel Carson Research Reserve, Vandenburgh is investigating how clam larval export from Marine Protected Areas (MPAs) affects recruitment outside of reserves. Her studies may help determine the contribution of MPAs to the productivity of fisheries.

Vandenburgh earned bachelor's degrees in both aquatic biology and anthropology at the University of Texas at Austin.

Currently, she is a doctoral student in ecology at the University of North Carolina at Chapel Hill Institute of Marine Sciences in Morehead City. The program "incorporates both natural and social sciences," according to Vandenburgh.

"I plan to use my diverse background and experience to find realistic solutions to fishery management problems by developing a career in marine policy and resource management," Vandenburgh explains. — C.H.

Courtesy of Somerset Place



Ken Taylor

Ken Taylor

Marie Read

Courtesy of Somerset Place

Courtesy of Somerset Place

TOP ROW: At Somerset Place, the antebellum mansion and other buildings are decorated with traditional designs and natural materials.
MIDDLE ROW: Each December, thousands of tundra swans, Canada geese and other waterfowl return to Lake Mattamuskeet in Hyde County.
BOTTOM ROW: During the holiday open house at Somerset Place, visitors can sample black-eyed peas cooked outside on an open fire and enjoy Christmas music.

Take a Glimpse Into Sound Country Holiday Traditions

By Ann Green

After Rosa Hernandez moved from Mexico to the Sound Country community of Columbia, she became homesick for the Hispanic holiday homage to Mary and Joseph.

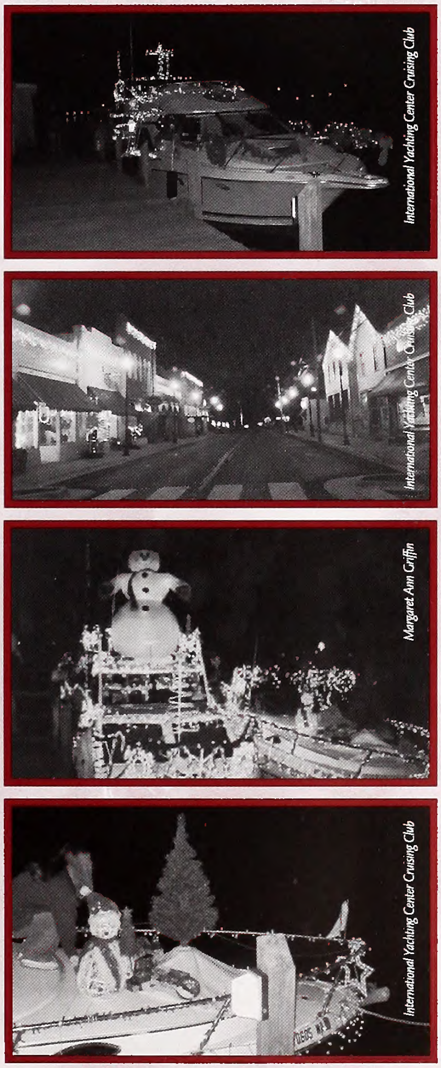
Dubbed "La Posada" — which means lodging or shelter in Spanish — the colorful re-enactment of the Holy Family's quest for lodging before the birth of baby Jesus has been carried out in Mexico for centuries. Both children and adults participate in a luminary procession to designated homes, where they often sing carols. A child, dressed as Mary and perched on a live burro, often leads the procession.

To carry on this old Hispanic tradition, Hernandez initiated a one night "La Posada" in 2001 as part of River Town Christmas on the Scuppernong in historic Columbia in Tyrrell County.

"This celebration is very important to me and my family because it tells us about the birth of Jesus Christ," says Hernandez. "We wanted to share this celebration with everybody. It is different from the celebration in Mexico where they have pilgrimages nine days before Christmas to signify the nine months of Mary's pregnancy."

The colorful tradition helps other residents in the growing Hispanic population in Tyrrell County feel more connected to the community.

"Hispanics are settling everywhere, including Tyrrell County," says Dorothy Redford, site manager of Somerset Place in nearby Washington County. "New immigrants are embraced and accepted here. Columbia is very open to newcomers for a small southern town."


International Yachting Center Cruising Club
International Yachting Center Cruising Club
Margaret Ann Griffin
International Yachting Center Cruising Club

Each year, the community of Columbia celebrates River Town Christmas with a flotilla on the Scuppernong River and a parade in downtown Columbia.

LUMINARY PROCESSION

At this year's River Town Christmas, La Posada will be held on Saturday, Dec. 6. A group of children dressed as the Holy Family and followed by dozens of other participants will carry candles to several businesses and homes in downtown Columbia.

In keeping with the Spanish tradition, the group will knock on each door and sing "We are Mary and Joseph Looking for Shelter."

"At first, the family inside refuses to let them in," says Hernandez, a Tyrrell County teacher. "Then the travelers sing again and move on to another place."

Their journey culminates at the downtown fire station where they celebrate with Mexican food and drinks, including enchiladas, atole — a sweet drink made from cornmeal — and other dishes. Then the children knock down the piñata filled with goodies.

The 5th Annual River Town Christmas on the Scuppernong, which runs Dec. 4-6, also includes a flotilla — a lighted boat parade on the Scuppernong River.

"We usually have between eight and 12 boats lighted and decorated with everything from snowmen to birds and a Christmas tree," says Luittard Dietrich, one of the owners of the International Yachting Center in Columbia.

Continued

The event also includes a Christmas bazaar and open house at the Partnership for the Sound's Columbia Theatre.

"This is a local-oriented festival with local vendors," says Tessi Hollis, chairperson of the 2002 River Town Christmas. "We want to give natives a reason to come home."

River Town Christmas is more than a celebration. Across North Carolina, festivals help boost local economies.

TRAVEL STUDY

A new study from the Travel Industry Association of America (TIA) and *Smithsonian Magazine* lists North Carolina as one of the top 10 destinations for cultural, arts, historic and heritage activities.

The study also found that heritage and cultural travelers spend more money as compared to the average U.S. trip — $623 vs. $457, excluding cost of transportation — making historic/cultural travel a lucrative market.

"North Carolina is rich with cultural and heritage assets that continue to lure millions of visitors to our state," says Lynn Minges, executive director of the N.C. Division of Tourism, Film and Sports Development. "We have focused on development of this growing market segment, and those efforts have paid off."

The study also noted that 30 percent of historic/cultural travelers choose a destination based on a specific historic or cultural event or activity. These travelers are more likely to stay seven nights or longer, fly or rent cars and book hotel rooms. In fact, four in 10 added extra time to their trip specifically because of a historical/cultural activity.

North Carolina's heritage tourism program began in 1996 and was designed to help preserve, protect and promote the state's cultural and heritage assets.

In recent North Carolina Sea Grant birding surveys conducted in North Carolina, researchers found that many of North Carolina's visitors also were interested in historical and cultural attractions, according to Sea Grant Extension Director Jack Thigpen.

"This may create marketing opportunities for nature-based businesses and people involved with cultural places and events," Thigpen adds. "For example, cross-advertising in birding magazines and history publications, partnering with local complimentary businesses may have pay-offs for everyone."

SOMERSET OPEN HOUSE

In North Carolina, many cultural travelers stop at Somerset Place in Washington County to kindle the holiday spirit during an annual open house.

In spite of damage from Hurricane Isabel, the event is being held this year on Dec. 7 from 1 to 4 p.m.

At Somerset Place — once a thriving antebellum plantation with more than 100,000 acres — visitors can glimpse holiday traditions as they were before the Civil War.

"This is our 15th year to celebrate a traditional Christmas at Somerset," says Redford. "We create the past by decorating buildings with natural materials — from fruit to magnolia leaves."

The present site includes 31 of the original lakeside acres and seven original 19th century buildings, including the kitchen, slave house and laundry. A large labor force built these buildings. Over the plantation's life from 1785 to 1865, there were 50 white employees, two free black employees and more than 850 enslaved people.

Since much of the plantation life centered around the kitchen, visitors can see how a 19th century kitchen operated and sample homemade cornbread and black-eyed peas cooked over an open fire.

The 14-room antebellum mansion of planter Josiah Collins III — with its expansive porches, formal gardens and expensive furnishings — also will be open.

Community churches decorate each room in honor of a past or present member, held in high esteem. Also, people in nearby communities are invited to add arrangements that honor volunteers who helped during the aftermath of Hurricane Isabel.

During the Somerset open house, volunteers from the churches greet visitors, talk about the honorees and display Christmas decorations. Any honoree still living also greets visitors. As a permanent tribute, a biographical sketch is written about the honoree. The write-ups are published each year as *Reflections: A Somerset Christmas.* Since 1990, 124 people have been honored.

"Last year, we honored volunteer firemen and health care professionals," says Redford. "This year, the churches can choose anyone for the program. Typically, these individuals never sought public recognition but lived honorable lives and had a lasting and positive impact on others. We also will be celebrating random acts of kindness in a crisis. I am inspired by stories of people extending themselves in a wonderful way."

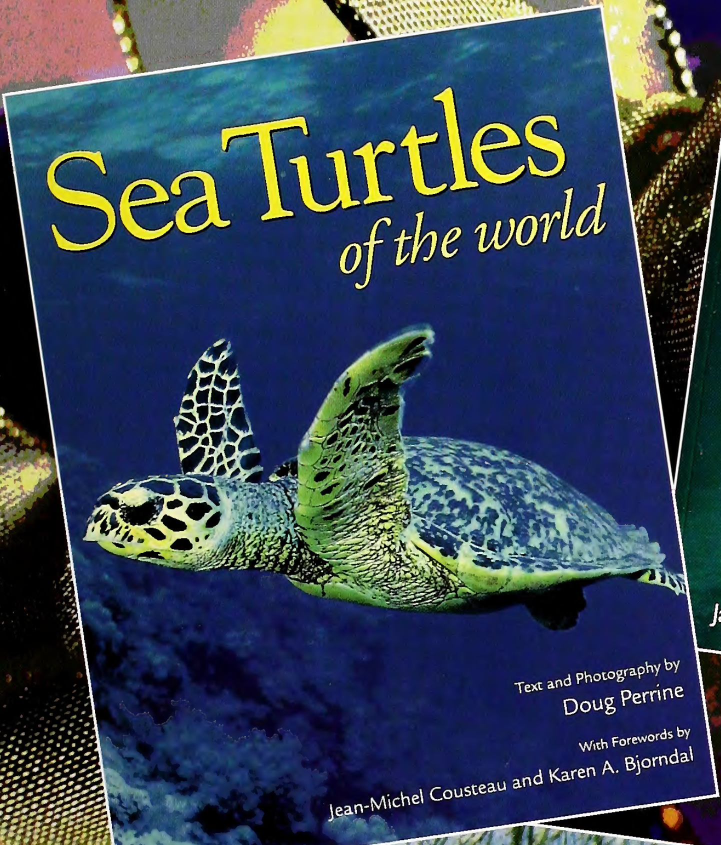
For example, after Hurricane Isabel, some people came from Greenville with a truck and cooker and gave out string beans and potatoes to anybody who passed the house, according to Redford.

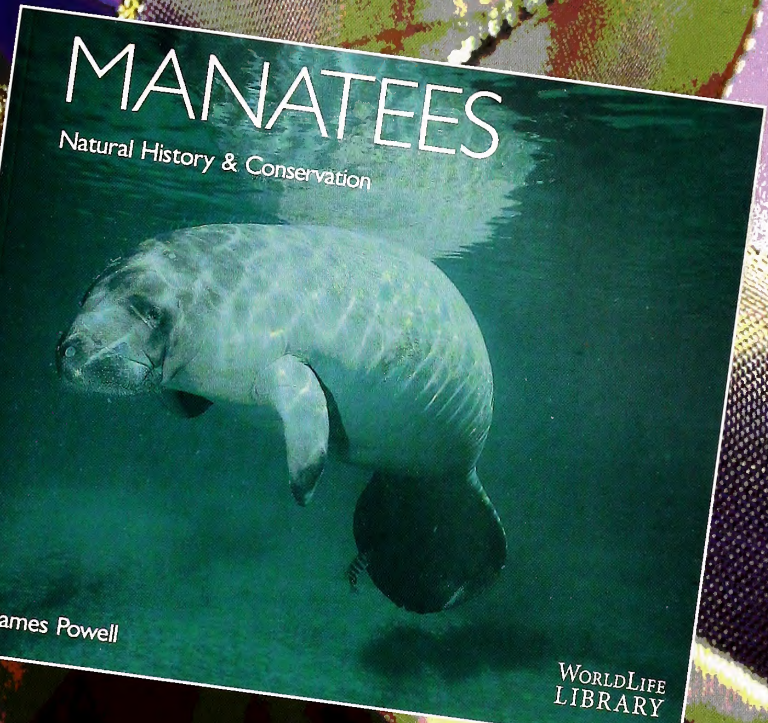
The tradition of honoring community members was started to get the whole community involved in Somerset Place.

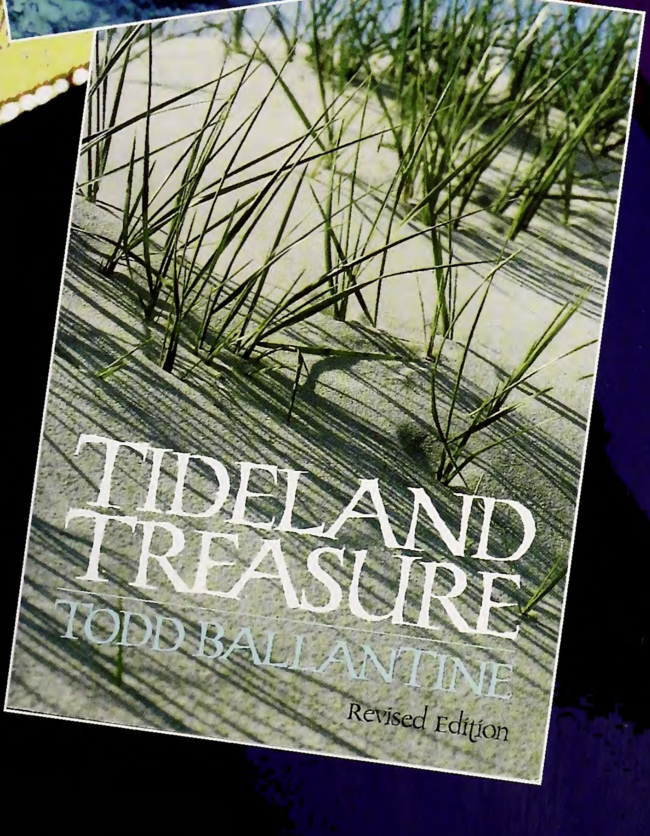
After the first homecoming of slave descendants in 1986, some whites felt alienated, says Redford, who is a seventh-generation descendant of the first slaves to toil the plantation.

"This open house helps to build a cohesive community," she says. "All the church choirs come together and sing together. It is truly an ecumenical event." ■

To find out more about River Town Christmas in Columbia, call 252/796-0723 or e-mail, vifitrtc@beachlink.com. *For details on the Somerset Open House, call 252/797-4560 or visit the Web:* www.ncdcr.gov *and click on historic sites.*







Picture Your Holiday with a Book

By Lilly Loughner

The holidays are for relaxation, togetherness with family and escape from the bustle — just as much as they are littered with the biggest shopping days of the year. You may be wondering how you can relax when your shopping list is growing by the mile.

Just relax. The solution is packaged in a timeless form: a book, but not any book, a picture book. Books graced by the unique lives of coastal creatures speak to audiences of all ages and backgrounds.

Those harboring but a mere glimmer of interest in marine life, will be hooked and taken wholly into the photos, drawings and words.

Readers will become the diver accompanying a sea turtle voyage, the fisher marveling at a manatee sighting, or the heron watching serenely over the swamp.

Continued

• **MANATEES: NATURAL HISTORY & CONSERVATION**, *by James Powell. 2002. Voyageur Press, Inc., Stillwater, MN 55082. 72 pages. Paperback, $16.95. ISBN 0-89658-583-2.*

Anyone harboring a soft spot for marine animals will enjoy *Manatees*. Adults and children alike will pause at each photograph, displaying the primitive beauty of the manatee in a variety of habitats and poses. Powell opens with recollections of his earliest interest in manatees: "My father had no need to tell me to be quiet, I'm not sure I was breathing. It was a 'sea cow,' he told me in his southern drawl, or a 'manatee.' "

The manatee's benign nature is magnified by the fact that "these placid creatures that suffer so at the hands of man and his machines, approach and actively solicit human contact: not to be fed or rewarded in any other way but to be touched."

Powell educates as he details the origins and biology of the manatee, beginning with the obvious question: What exactly is a manatee? While they bear a facial resemblance to walruses and are often called sea cows, they actually "belong to an interesting group of mammals referred to as subungulates and may be distantly related to ungulates or hooved mammals such as cattle, horses, and deer," writes Powell.

Powell successfully brings the biological, conservation and emotional aspects of the manatee existence full circle.

Parents should hoist children into their laps as they read the chapter, "A Year in the Life of a Florida Manatee."

In this fictional tale inspired by his 30 years of experience in manatee observation, Powell traces the life of a Florida manatee called Tia. Here we are introduced to a strange and unusual environment full of "its own peculiar complement of sounds from snapping shrimp, grunts and the noise of lapping waves over the oyster bars."

Through Tia, we witness the miracle of her calf's birth: "He makes a couple of quick strokes with his tail and breaks free from his umbilicus and birth sac, then shoots for the surface while his mother helps by nudging him upward with her muzzle."

The fate of Tia and her calf brings to light the urgency for the protection of the manatee as mortality increases due to collisions with watercraft, ingestion of trash, hunting and habitat change.

• **TIDELAND TREASURE**, *by Todd Ballantine. 1991. University of South Carolina Press, Columbia, SC 29208. 218 pages. Paperback, $14.35. ISBN 0-87249-795-x.*

The lack of long, complicated scientific names takes nothing away from this valuable resource packed with coastal information, focusing specifically on Hilton Head Island and the southeastern coast. Ballantine provides poetic, and often comical, descriptions of anything anyone would ever want to know about visiting the beach.

In *Tideland Treasure*, tides become "the heartbeat of nature," the ocean a "pea green porridge," a loggerhead turtle a "wandering giant," and a tick a "bloodthirsty vampire of the bush."

Ballantine depicts the components of the sea, beach, salt marsh, plants, animals and coastal conservation through a unique blend of detailed drawings, diagrams and seemingly handwritten notes. Therefore, *Tideland Treasure* reads like a personal nature journal.

Children will find this book visually pleasing and readable with its comic-bookish illustrations and text. Adults will cherish it for the same reason.

The content is also intriguing. Did you ever wonder, "Why marsh mud smells bad?" "The fine-packed sediments are oxygen-poor. Here native 'anaerobic' bacteria decays bottom matter and releases hydrogen sulfide (H_2S) — poisonous gas smelling of rotten eggs," writes Ballantine.

Readers also learn how to make sand dollar jewelry — an art passed down from native Escamacu Indians.

Tideland Treasure serves as a reference that all beach lovers should keep on hand. There's always something new to discover at the beach.

• **SEA TURTLES OF THE WORLD**, *by Doug Perrine. 2003. Voyageur Press, Inc., Stillwater, MN 55082. 144 pages. Hardback, $29.95. ISBN 0-89658-555-7.*

"Without a change in the human population trend, turtles and many other wild animals face a very bleak future. ...It is my fervent hope that every reader of this book will have no more than four grandchildren, every one of whom will have the opportunity to see a great armada of

armored reptiles emerge from the ocean to fling sand wildly about on some remote, untamed beach." So *Sea Turtles of the World* begins.

Perrine intends not only to educate readers about sea turtle origins, biology and behavior, but also to enlighten them, move them in a way that makes conservation seem less of a political or cultural mindset and more of a necessity.

And the pictures do just that. Turning each page becomes a pleasure as you flip from a photograph of a "green turtle hatchling" gliding peacefully in a sea of shimmering blue to a female olive ridley as she "excavates the egg chamber of her nest on an arribada beach in Costa Rica."

Sea Turtles of the World does not come short with text to back up the amazing photography. The writing is true to its intent to teach the past, present and future of the sea turtle in an interesting and positive light.

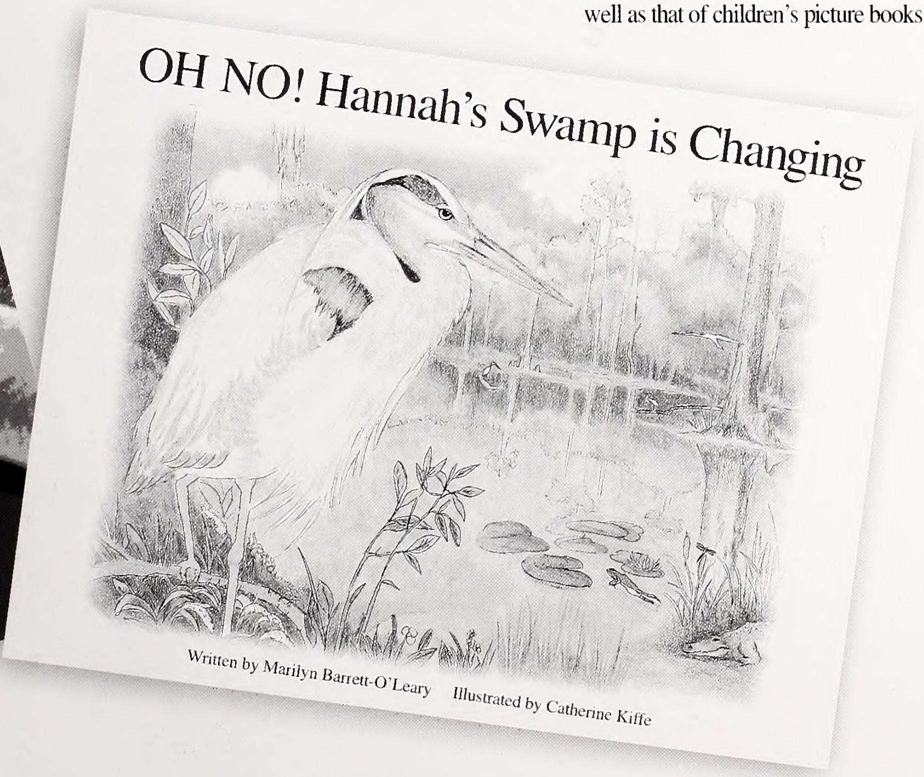
According to Perrine, the evolutionary beginnings of the turtle remain a mystery. Yet the oldest fossils found of the marine turtle date to 208-145 million years ago — from the Jurassic period.

A "families and species" section in the book serves as a detailed index for the seven species of sea turtles — green sea turtle, loggerhead turtle, hawksbill turtle, olive ridley turtle, Kemp's ridley turtle, Australian flatback turtle and the leatherback turtle.

Perinne provides tips and cautions for watching sea turtles from land and water. Taking care not to disturb them, "observers are treated to a rare glimpse into the lives of these fascinating survivors from the Age of Dinosaurs," he relates.

• **OH NO! HANNAH'S SWAMP IS CHANGING**, *by Marilyn Barrett-O'Leary, with illustrations by Catherine Kiffe. 2002. Louisiana Sea Grant, Baton Rouge, LA 70803. 30 pages. Paperback, $10.*

Oh No! Hannah's Swamp is Changing inspires a new outlook on the natural world as well as that of children's picture books.


OH NO! Hannah's Swamp is Changing
Written by Marilyn Barrett-O'Leary
Illustrated by Catherine Kiffe

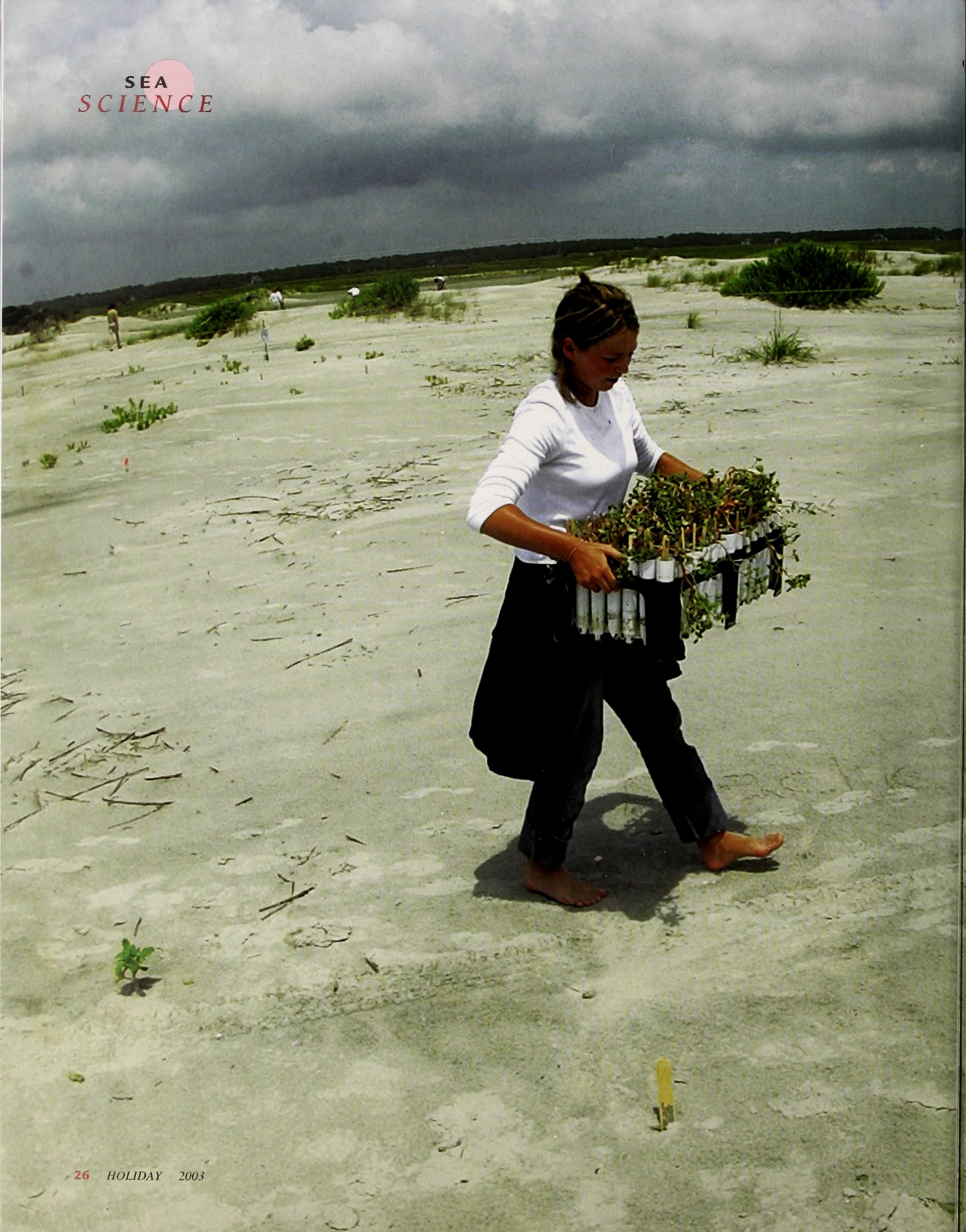
Kiffe, an artist and teacher, creates striking illustrations, in part, because they were created by crayon. Kids will relate to the pictures because they've experienced firsthand the amazing possibilities that erupt from the tip of a crayon. Adults will be amazed by the simple beauty expressed in the drawings, and taken back to a time where coloring inside the lines was their only worry.

The story that lent its inspiration to the pictures is moving as well as educational — having been spawned from Louisiana Sea Grant's aquatic education program. Hannah the heron shares the wonder of her swamp with readers as she sees it, a home and a living system. Hannah possesses love and knowledge of her surroundings, as all living creatures should — a lesson that humans must learn through the conflict of the book.

Due to human negligence, a nonindigenous species, the water hyacinth, is introduced into the swamp. And just when Hannah begins to fear the worst for her delicate home, the humans help. As the ecosystem is restored, Hannah's faith in the people is restored. O'Leary writes, "Hannah sees that people care for the habitat. They work to keep the ecosystem healthy."

Vocabulary words, such as habitat, ecosystem and native species, are introduced into the reading to help children along. A glossary is located at the back of the book along with a coloring poster. The poster features hidden pictures of plants and animals native to Louisiana for kids to locate and color, clinching the book as a dynamic learning and leisure activity for those wishing to escape into the imaginative world of Hannah's swamp.

To purchase *Oh No! Hannah's Swamp is Changing*, navigate to this section of the Louisiana Sea Grant Web site: *www.lamer.lsu.edu/classroom/nis/index.htm.* Then download the order form and follow directions from there. For further questions, call Marilyn Barrett-O'Leary at 225/578-6349 or send e-mail to *moleary@lsu.edu.* ◘



Researchers Survey Bird Island Flora

By Ann Green • Photos by Jeff Otto

In the middle of a hot, dry sandy dune on Bird Island, North Carolina Sea Grant researcher Kristen Rosenfeld notices a tiny sprig of vegetation.

"This is a cool plant," says Rosenfeld, a North Carolina State University graduate student. "It is an herb."

The sea rocket or *Cakile edentual* is just one type of plant that Rosenfeld finds while surveying the 10-meter square area. She finds five species in this small plot on Bird Island, near the tip of Brunswick County off Sunset Beach.

"This is a good number for a plot on a beach," says Rosenfeld. "There are not many plants that can live in this harsh environment. Plants have to be drought tolerant and tolerant of the salt spray from the ocean and overwash."

During the past two summers, Rosenfeld has conducted a vegetation survey on Bird Island, the state's newest coastal reserve. In 2002, the state bought the island for $4.2 million from the Price family of Greensboro.

"The plants give an indication of what the ecosystem is like," says Rosenfeld. "About 10 to 15 percent of the beach is covered with vegetation. Preliminary data show that there are more than 125 plant species on the island."

One unexpected result was not finding any seabeach amaranth or *Amaranthus pumilus*, a dune plant that lived on the island until the 1980s, according to Rosenfeld. "We also expected to find a maritime forest, but there is no forested area," she adds. "In fact, there are only a handful of trees on the island."

In addition to the dune plants, Sea Grant researchers found large grasslands, shrub thickets and salt marshes dominated by smooth cordgrass, *Spartina alterniflora*.

"We suspect that the grasslands represent the dunes that once faced the ocean 75 or 100 years ago," says Rosenfeld. "This area may give us a clue to what the island was like before any kind of human involvement. It is possible that the U.S. Army Corps of Engineers' jetty on the South Carolina end of Bird Island has changed the sand and sediment transport and altered the island shape from round to long and narrow."

The baseline vegetation survey will help the N.C. Coastal Reserve Program in management, conservation and restoration efforts, according to the study's co-investigator Thomas Wentworth, an NC State botany professor.

The information also will go into a database for the Carolina Vegetation Survey, a comprehensive compilation of the state's plants and their ecological habitats. The survey likely will take several more years to complete.

"When completed, the Carolina Vegetation Survey will provide a comprehensive inventory of the remarkable diversity of natural communities found in North and South Carolina," says Wentworth.

BIRD ISLAND OVERVIEW

Spread over nearly 1,300 acres, Bird Island is accessible by walking from the western end of Sunset Beach across the former location of Mad Inlet.

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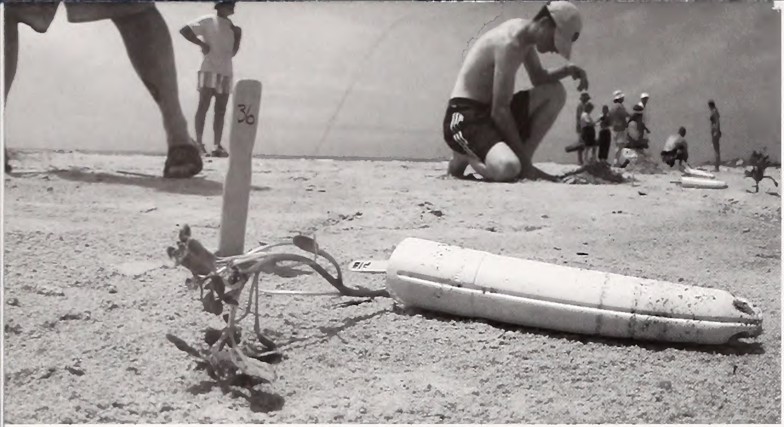
LEFT: NC State student Rachel Brown carries a flat of seabeach amaranth along the sandy beach at Bird Island.



The island is a critical habitat for a variety of plants and animals. Both sea oats and wax myrtle grow on the island. Also, threatened loggerhead sea turtles, threatened piping plovers, endangered wood starks and black skimmers – a state species of special concern – are found on the island.

"Mad Inlet used to separate Bird Island from Sunset Beach until 1997," says John Taggart, director of the N.C. Coastal Reserve Program. "The closed inlet area is dynamic and serves as a good potential nesting habitat for colonial waterbirds. Historically, portions of the island hosted lots of terns and skimmers, but predation and disturbance by foxes and other animals have greatly reduced nesting success. However, we will protect the former inlet area to encourage nestings."

Because Bird Island is on the southern part of the coast and is oriented east-west, it has different dynamics than barrier islands that are oriented north-south. This area is accreting sand in comparison to Masonboro Island, a reserve near Wilmington, which is eroding.

The acquisition ensures that more than 1,000 acres of wetlands and tidal marshes will be protected, providing a buffer for primary nursery areas for fish, adds Taggart. Before the island was purchased, it was subject to significant development pressures. Brunswick County is one of the fastest-growing counties on the coast.

Although state regulations control development of coastal wetlands, some filling and shading of the wetlands is allowed when necessary for shoreline stabilization or dock construction associated with upland development, according to Taggart.

The island purchase ensures protection of 1.2 miles of ocean shoreline and 1.5 miles of shoreline on the sound side of the island. Preservation of the shoreline will help prevent further degradation of surrounding waters, says Taggart.

ROLE OF DUNE PLANTS

At Bird Island and other beaches, dune plants play an important role in the coastal ecosystem.

"Plants trap blowing sand, causing the formation of sand dunes and the stabilization of barrier island soils," according to *The Dune Book*, published by North Carolina Sea Grant. "As the dune field grows, multiple dunes line the beach, providing habitat for animals, birds, amphibians and reptiles."

In the summer of 2003, nearly 20 scientists and volunteers planted seabeach amaranth – a federally threatened species – near

TOP: Scientists and volunteers gathered on a hot summer day to plant seabeach amaranth. MIDDLE: Rachel Brown, front left, and Kristen Rosenfeld show volunteers the proper way to plant seabeach amaranth. BOTTOM: John Taggart uses post-hole diggers to make a hole for a new plant.

the pounding surf. The study is funded by the U.S. Fish & Wildlife Service.

Historically, the herb, an annual that dies at the end of each season, occurred in 31 counties in nine states from Massachusetts to South Carolina. However, now, there are only 1,000 to 3,000 seabeach amaranth left from Delaware to Georgia, according to the U.S. Fish & Wildlife Service. In North Carolina, the dune plants can be found on many beaches south of Cape Hatteras.

"The last time that seabeach amaranth was found on Bird Island was in 1989," says Dale Suiter, an endangered species biologist with the U.S. Fish & Wildlife Service. "The habitat may have been destroyed by hurricanes and tropical storms."

Before planting the seabeach amaranth, Rosenfeld, who was wearing long pants and a long-sleeve shirt to avoid sunburn on a hot day, demonstrated the proper way to plant, including placing the plant in the back of the hole and then filling it with sand.

"We would like to have two teams of workers," she says. "One group will dig the holes, and the others will water the plants."

With shovels in their hands, the group planted more than 300 plants in seven rows, each set two meters apart.

"These plants are very adapted to this environment," says David Nash, North Carolina Cooperative Extension extension agent in coastal management and commercial horticulture for Brunswick and New Hanover counties. "However, they are tender. A lot get broken through handling."

For Sarah McCurdy of Hiddenite in Alexander County, the planting provided an opportunity to learn about different vegetation on a barrier island. "It is hot and sandy here," she says. "At home, we plant tobacco in red clay. This is the other end of the extreme."

If the plants survive, they will be an effective sand binder, building dunes where they grow. Once the dunes are created, longer-lasting plants like sea oats and bitter panicum can take root.

"It is our hope that this study will teach us something about the basic biology of seabeach amaranth as well as contribute in a small way to the long-term recovery of the species," says Rosenfeld. "If the plants we put out on Bird Island are successful, they could potentially generate thousands and thousands of seeds that will be put back out into the environment."

For more information about Bird Island, visit www.ncnerr.org *and click on reserve sites. To find out more about the vegetation survey, go online to* www.bio.unc.edu/faculty/peet/lab/CVS.

North Carolina Coastal Reserve
Bird Island
A Dedicated State Nature Preserve
Clean Water Preserve

TOP: A volunteer checks to see if a hole is deep enough for a seabeach amaranth planting. MIDDLE: Seabeach amaranth provide protection for sand dunes on coastal beaches. BOTTOM: Bird Island is a critical habitat for a variety of plants and animals.

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